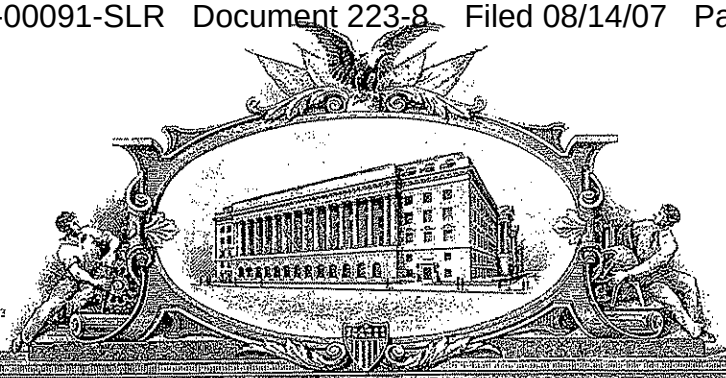
EXHIBIT F



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

December 04, 2006

THIS IS TO CERTIFY THAT ANNEXED IS A TRUE COPY FROM THE RECORDS OF THIS OFFICE OF THE FILE WRAPPER AND CONTENTS OF:

APPLICATION NUMBER: *09/873,642*
FILING DATE: *June 04, 2001*
PATENT NUMBER: *6,503,156*
ISSUE DATE: *January 07, 2003*

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office

T. WALLACE
Certifying Officer

06-05-01

Form 3.54 Division-continuation
program application transmittal form
37 C.F.R. 1.53(b)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No. P-3724-F1-C1-C3
SLD 2 035-3-3-1-1-1(III)
IN RE APPLICATION OF: Sullivan
Prior application: 09/776,278

The Assistant Commissioner for Patents
Washington, D.C. 20231
Box Patent Application

Sir:

This is a request for filing a continuation application under 37 C.F.R. 1.53(b), of pending prior application **U.S. Application Serial No. 09/776,278 filed February 2, 2001...(See Data Sheet for Cross References)**

Inventors: Michael J. Sullivan

For: **GOLF BALL HAVING MULTI-LAYER COVER WITH UNIQUE OUTER COVER CHARACTERISTICS**

1. **Papers Enclosed Which Are Required For Filing Date under 37 CFR 1.53(b) (Regular) or 37 CFR 1.153 (Design) Application**

   34 Pages of specification
   3 Pages of claims
   1 Page of Abstract
   1 Sheets of drawing

2. ____ A PRELIMINARY AMENDMENT is enclosed.

3. ____ Applicant claims small entity status.

4. ____ Request and Certification Under 35 U.S.C. 122(b)(2)(B)(i)

CERTIFICATE OF EXPRESS MAIL

I hereby certify that this **TRANSMITTAL LETTER and associated papers** are being deposited with the United States Postal Service by Express Mail Procedure in an envelope addressed to: Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231 on June 4, 2001. **Express Mailing Label No.** EL 852784875 US.

Mary Ann Temesvari
Mary Ann Temesvari

5. x The filing fee is calculated below.

CLAIMS AS FILED IN THE PRIOR APPLICATION LESS ANY CLAIMS CANCELED BY PRELIMINARY AMENDMENT			
Basic Filing Fee (Large Entity)			$ 710.00
		No. of Extra Claims Present	Additional Rate
Total Claims	17		$
Indep. Claims	3		$
		Total fee	**$ 710.00**

6. xxx A check in the amount of $710.00 is enclosed.

7. xxx The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Account No. 06-0308.

8. XXX The prior application is assigned of record to Spalding Sports Worldwide, Inc., as recorded in the U.S. Patent and Trademark Office.

9. xxx An Application Data Sheet is enclosed.

10. xxx The declaration/power of attorney in the prior application is to Richard M. Klein, Reg. No. 33,000. Copies of the declaration/power of attorney in the prior application are enclosed. Please address all future communications to:

Michelle Bugbee
Patent Counsel
Spalding Sports Worldwide, Inc.
425 Meadow Street
PO Box 901
Chicopee, MA 01021-0901

Customer No. 24492

11. Please direct all phone calls to Richard M. Klein or Mark E. Bandy at telephone No. (216)861-5582.

6/4/2001
Date

Richard M. Klein
Reg. No. 33,000
Mark E. Bandy
Reg. No. 35,788
FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP
1100 Superior Avenue, 7th Floor
Cleveland, Ohio 44114
(216) 861-5582

C:\DATA\MEB\S2035331.TR3

Attorney Docket No.: P-3724-F1-C1-C3
(SLD 2035-3-3-1-1-1(III))

APPLICATION DATA SHEET

Inventor Information

Inventor One Given Name::	Michael J.
Family Name::	Sullivan
Postal Address Line One::	3 River Oak Road
City::	Barrington
State or Province::	RI
Postal or Zip Code::	02806
Citizenship Country::	US

Correspondence Information

Name Line One::	Michelle Bugbee
Name Line Two::	Spalding Sports Worldwide, Inc.
Address Line One::	425 Meadow Street
Address Line Two::	PO Box 901
City::	Chicopee
State or Province::	MA
Postal or Zip Code::	01021-0901
Telephone::	(413)322-2937
Fax::	(413)322-2575
E-Mail::	MBugbee@Spalding.com
Customer No.::	24492

Additional Correspondence Information

Name Line One::	Richard M. Klein
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	RKlein@faysharpe.com

Application Information

Title Line One::	Golf Ball Having Multi-Layer Cover With
Title Line Two::	Unique Outer Cover Characteristics
Total Drawing Sheets::	1
Formal Drawings?::	Yes
Application Type::	Utility

Representative Information

The following have a power of Attorney or autorization of agent in this application:

Name Line One::	Michelle Bugbee
Name Line Two::	Spalding Sports Worldwide, Inc.
Address Line One::	425 Meadow Street
Address Line Two::	PO Box 901
City::	Chicopee
State or Province::	MA
Postal or Zip Code::	01021-0901
Telephone::	(413)322-2937
Fax::	(413)322-2575
E-Mail::	MBugbee@Spalding.com
Registration No.::	42,370

Name Line One::	Richard M. Klein
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	RKlein@faysharpe.com
Registration No.:	33,000

Name Line One::	Mark E. Bandy
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	MBandy@faysharpe.com
Registration No.:	35,788

Name Line One::	Brian G. Bembenick
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	BBembenick@faysharpe.com
Registration No.:	41,463

Continuity Information

This application is a::	Continuation of
> Application One::	09/776,278
Filing Date::	February 2, 2001
which is a::	Continuation of
> Application Two::	09/470,196
Filing Date::	December 21, 1999
which is a::	Continuation of
>> Application Three::	08/870,585
Filing Date::	June 6, 1997
which is a::	Continuation of
>>> Application Four:	08/556,237
Filing Date::	November 9, 1995
Status::	Abandoned
which is a::	Continuation-in-Part of
>>> Application Five:	08/070,510
Filing Date::	June 1, 1993
Status::	Abandoned

Prior Foreign Applications

Foreign Application One::
Filing Date::
Country::
Priority Claimed:: (Y or N)

Assignee Information

The Assignee of this application is to:

SPALDING SPORTS WORLDWIDE, INC.
425 Meadow Street, PO Box 901
Chicopee, MA 01021-0901
(413) 322-2937

Richard M. Klein
Reg. No.33,000
Mark E. Bandy
Reg. No. 35,788
1100 Superior Avenue
7th Floor
Cleveland, OH 44114-2518
Telephone No. (216)861-5582
Customer No. 24492

C:\DATA\DATASHEE\SLD\20353311 13

GOLF BALL HAVING MULTI-LAYER COVER WITH UNIQUE OUTER COVER CHARACTERISTICS

Cross References to Related Applications

The present application is a continuation of U.S. Application Serial No. 09/776,278 filed February 2, 2001 which is a continuation of U.S. Application Serial No. 09/470,196 filed on December 21, 1999, which is a continuation of U.S. application Serial No. 08/870,585 filed June 6, 1997, which is a continuation of U.S. Application Serial No. 08/556,237 filed November 9, 1995 now abandoned, which is a continuation-in-part of U.S. Application Serial No. 08/070,510 filed on June 1, 1993, now abandoned.

Field of the Invention

The present invention relates to golf balls and, more particularly, to improved standard and oversized golf balls comprising multi-layer covers which have a comparatively hard inner layer and a relatively soft outer layer such as that produced by the use of a polyurethane based outer layer. The improved multi-layer golf balls provide for enhanced distance and durability properties over single layer cover golf balls while at the same time offering enhanced "feel" and spin characteristics generally associated with soft balata and balata-like covers of the prior art.

Background of the Invention

Traditional golf ball covers have been comprised of balata or blends of balata with elastomeric or plastic materials. The traditional balata covers are relatively soft and flexible. Upon impact, the soft balata covers compress against the surface of the club producing high spin. Consequently, the soft and flexible balata covers provide an experienced golfer with the ability to apply a spin to control the ball in flight in order to produce a draw or a fade, or a backspin which causes the ball to "bite" or stop abruptly on contact with the green. Moreover, the soft balata covers produce a soft "feel" to the low handicap player. Such

playability properties (workability, feel, etc.) are particularly important in short iron play with low swing speeds and are exploited significantly by relatively skilled players.

Despite all the benefits of balata, balata covered golf balls are easily cut and/or damaged if mis-hit. Golf balls produced with balata or balata-containing cover compositions therefore have a relatively short lifespan.

As a result of this negative property, balata and its synthetic substitutes, transpolyisoprene and transpolybutadiene, have been essentially replaced as the cover materials of choice by new cover materials comprising ionomeric resins.

Ionomeric resins are polymers containing interchain ionic bonding. As a result of their toughness, durability and flight characteristics, various ionomeric resins sold by E. I. DuPont de Nemours & Company under the trademark Surlyn® and more recently, by the Exxon Corporation (see U. S. Patent No. 4,911,451) under the trademarks Escor® and Iotek®, have become the materials of choice for the construction of golf ball covers over the traditional "balata" (transpolyisoprene, natural or synthetic) rubbers. As stated, the softer balata covers, although exhibiting enhanced playability properties, lack the durability (cut and abrasion resistance, fatigue endurance, etc.) properties required for repetitive play.

Ionomeric resins are generally ionic copolymers of an olefin, such as ethylene, and a metal salt of an unsaturated carboxylic acid, such as acrylic acid, methacrylic acid, or maleic acid. Metal ions, such as sodium or zinc, are used to neutralize some portion of the acidic group in the copolymer resulting in a thermoplastic elastomer exhibiting enhanced properties, i.e. durability, etc., for golf ball cover construction over balata. However, some of the advantages gained in increased durability have been offset to some degree by the decreases produced in playability. This is because although the ionomeric resins are very durable, they tend to be very hard when utilized for golf ball cover construction, and thus lack the degree of softness required to impart the spin necessary to control the ball in flight. Since the ionomeric resins are harder than balata, the ionomeric resin covers do not compress as much against the face of the club upon

impact, thereby producing less spin. In addition, the harder and more durable ionomeric resins lack the "feel" characteristic associated with the softer balata related covers.

As a result, there are currently more than fifty (50) commercial grades of ionomers available both from DuPont and Exxon, with a wide range of properties which vary according to the type and amount of metal cations, molecular weight, composition of the base resin (i.e., relative content of ethylene and methacrylic and/or acrylic acid groups) and additive ingredients such as reinforcement agents, etc. However, a great deal of research continues in order to develop a golf ball cover composition exhibiting not only the improved impact resistance and carrying distance properties produced by the "hard" ionomeric resins, but also the playability (i.e., "spin", "feel", etc.) characteristics previously associated with the "soft" balata covers, properties which are still desired by the more skilled golfer.

Consequently, a number of two-piece (a solid resilient center or core with a molded cover) and three-piece (a liquid or solid center, elastomeric winding about the center, and a molded cover) golf balls have been produced by the present inventor and others to address these needs. The different types of materials utilized to formulate the cores, covers, etc. of these balls dramatically alter the balls' overall characteristics.

In addition, multi-layered covers containing one or more ionomer resins have also been formulated in an attempt to produce a golf ball having the overall distance, playability and durability characteristics desired. For example, this was addressed by Spalding Sports Worldwide, Inc., the assignee of the present invention, in U. S. Patent No. 4,431,193 where a multi-layered, regular sized, golf ball is disclosed.

In the '193 patent, a multi-layer golf ball is produced by initially molding a first cover layer on a spherical core and then adding a second layer. The first layer is comprised of a hard, high flexural modulus resinous material such as type 1605 Surlyn® (now designated Surlyn® 8940). Type 1605 Surlyn® (Surlyn® 8940) is a sodium ion based low acid (less than or equal to 15 weight percent methacrylic acid) ionomer resin having a flexural modulus of about 51,000 psi. An

outer layer of a comparatively soft, low flexural modulus resinous material such as type 1855 Surlyn® (now designated Surlyn® 9020) is molded over the inner cover layer. Type 1855 Surlyn® (Surlyn® 9020) is a zinc ion based low acid (10 weight percent methacrylic acid) ionomer resin having a flexural modulus of about 14,000 psi.

The '193 patent teaches that the hard, high flexural modulus resin which comprises the first layer provides for a gain in coefficient of restitution over the coefficient of restitution of the core. The increase in the coefficient of restitution provides a ball which serves to attain or approach the maximum initial velocity limit of 255 feet per second as provided by the United States Golf Association (U.S.G.A.) rules. The relatively soft, low flexural modulus outer layer provides essentially no gain in the coefficient of restitution but provides for the advantageous "feel" and playing characteristics of a balata covered golf ball.

Unfortunately, however, while a ball of the '193 patent does exhibit enhanced playability characteristics with improved distance (i.e. enhanced C.O.R. values) over a number of other then known multi-layered balls, the ball suffers from poor cut resistance and relatively short distance (i.e. lower C.O.R. values) when compared to two-piece, single cover layer balls commercially available today. These undesirable properties make the ball produced in accordance with the '193 patent unacceptable by today's standards.

The present invention is directed to new multi-layer golf ball compositions which provide for enhanced coefficient of restitution (i.e, enhanced resilience or carrying distance) and/or durability properties when compared to the multi-layer balls found in the prior art, as well as improved outer cover layer softness and durability. As such, the playability characteristics (i.e., "feel", "click", "spin", etc.) are not diminished.

These and other objects and features of the invention will be apparent from the following summary and description of the invention, the drawings and from the claims.

Summary of the Invention

The present invention is directed to improved multi-layer golf ball cover compositions and the resulting multi-layer golf balls produced using the

improved compositions. The present invention provides, in the first aspect, a golf ball comprising a core, an inner cover layer having particular characteristics, and an outer cover layer, also with certain features. The inner cover layer has a Shore D hardness of at least 60 and comprises a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid. The outer cover layer has a Shore D hardness of from about 55 to about 59, a thickness of from about 0.01 to about 0.07 inches, and comprises a polyurethane material.

In another aspect, the present invention provides a golf ball comprising a core, and an inner cover layer and an outer cover layer. The inner cover layer has a Shore D hardness of at least 60, and comprises a blend of two or more low acid ionomers, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid. The outer cover layer has a Shore D hardness of from about 60 to about 68, a thickness of from about 0.01 to about 0.07 inches, and comprises a polyurethane material.

In yet another aspect, the present invention provides a golf ball comprising a core, an inner cover layer disposed on the core, and an outer cover layer disposed about the inner cover layer. The inner cover layer has a Shore D hardness of about 60 or more, and comprises an ionomeric resin including no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid having a modulus of from about 15,000 to about 70,000 psi. The outer cover layer has a Shore D hardness of from about 55 to about 68, a thickness from about 0.01 to about 0.07 inches, and comprises a polyurethane material.

It has been found that multi-layer golf balls having inner and outer cover layers exhibit higher C.O.R. values and have greater travel distance in comparison with balls made from a single cover layer. In addition, it has been found that use of an inner cover layer constructed of a blend of low acid (i.e., 16 weight percent acid or less) ionomer resins produces softer compression and higher spin rates than inner cover layers constructed of high acid ionomer resins. This is compounded by the fact that the softer polyurethane outer layer adds to the desirable "feel" and high spin rate while maintaining respectable resiliency. The soft outer layer allows the cover to deform more during impact and increases the

area of contact between the club face and the cover, thereby imparting more spin on the ball. As a result, the soft polyurethane cover provides the ball with a balata-like feel and playability characteristics with improved distance and durability.

Consequently, the overall combination of the inner and outer cover layers made from blends of low acid ionomer resins and polyurethane results in a standard size or oversized golf ball having enhanced resilience (improved travel distance) and durability (i.e. cut resistance, etc.) characteristics while maintaining and in many instances, improving the balls playability properties.

The combination of a low acid ionomer blend inner cover layer with a soft, relatively low modulus ionomer, polyurethane based elastomer outer cover layer provides for overall coefficient of restitution (i.e., excellent resilience) while at the same time demonstrating improved compression and spin. The outer cover layer generally contributes to a more desirable feel and high spin, particularly at lower swing speeds with highly lofted clubs such as half wedge shots.

Two principal properties involved in golf ball performance are resilience and hardness. Resilience is determined by the coefficient of restitution (C.O.R.), the constant "e" which is the ratio of the relative velocity of two elastic spheres after direct impact to that before impact. As a result, the coefficient of restitution ("e") can vary from 0 to 1, with 1 being equivalent to an elastic collision and 0 being equivalent to an inelastic collision.

Resilience (C.O.R.), along with additional factors such as club head speed, angle of trajectory and ball configuration (i.e., dimple pattern) generally determine the distance a ball will travel when hit. Since club head speed and the angle of trajectory are factors not easily controllable by a manufacturer, factors of concern among manufacturers are the coefficient of restitution (C.O.R.) and the surface configuration of the ball.

The coefficient of restitution (C.O.R.) in solid core balls is a function of the composition of the molded core and of the cover. In balls containing a wound core (i.e., balls comprising a liquid or solid center, elastic windings, and a cover), the coefficient of restitution is a function of not only the composition of the center and cover, but also the composition and tension of the elastomeric windings. Although both the core and the cover contribute to the coefficient of

restitution, the present invention is directed to the enhanced coefficient of restitution (and thus travel distance) which is affected by the cover composition.

In this regard, the coefficient of restitution of a golf ball is generally measured by propelling a ball at a given speed against a hard surface and measuring the ball's incoming and outgoing velocity electronically. As mentioned above, the coefficient of restitution is the ratio of the outgoing velocity to the incoming velocity. The coefficient of restitution must be carefully controlled in all commercial golf balls in order for the ball to be within the specifications regulated by the United States Golf Association (U.S.G.A.). Along this line, the U.S.G.A. standards indicate that a "regulation" ball cannot have an initial velocity (i.e., the speed off the club) exceeding 255 feet per second. Since the coefficient of restitution of a ball is related to the ball's initial velocity, it is highly desirable to produce a ball having sufficiently high coefficient of restitution to closely approach the U.S.G.A. limit on initial velocity, while having an ample degree of softness (i.e., hardness) to produce enhanced playability (i.e., spin, etc.).

The hardness of the ball is the second principal property involved in the performance of a golf ball. The hardness of the ball can affect the playability of the ball on striking and the sound or "click" produced. Hardness is determined by the deformation (i.e., compression) of the ball under various load conditions applied across the ball's diameter (i.e., the lower the compression value, the harder the material). As indicated in U.S. Patent No. 4,674,751, softer covers permit the accomplished golfer to impart proper spin. This is because the softer covers deform on impact significantly more than balls having "harder" ionomeric resin covers. As a result, the better player is allowed to impart fade, draw or backspin to the ball thereby enhancing playability. Such properties may be determined by various spin rate tests such as the "nine iron" spin rate test described below in the Examples.

Accordingly, the present invention is directed to an improved multi-layer cover which produces, upon molding each layer around a core (preferably a solid core) to formulate a multi-layer cover, a golf ball exhibiting enhanced distance (i.e., resilience) without adversely affecting, and in many instances,

improving the ball's playability (hardness/softness) and/or durability (i.e., cut resistance, fatigue resistance, etc.) characteristics.

These and other objects and features of the invention will be apparent from the following detailed description.

Brief Description of the Drawings

FIG. 1 is a cross-sectional view of a golf ball embodying the invention illustrating a core 10 and a cover 12 consisting of an inner layer 14 and an outer layer 16 having dimples 18; and

FIG. 2 is a diametrical cross-sectional view of a golf ball of the invention having a core 10 and a cover 12 made of an inner layer 14 and an outer layer 16 having dimple 18.

Detailed Description of the Preferred Embodiments

The present invention relates to improved multi-layer golf balls, particularly a golf ball comprising a multi-layered cover 12 over a solid core 10, and method for making same.

The multi-layered cover 12 comprises two layers: a first or inner layer or ply 14 and a second or outer layer or ply 16. The inner layer 14 is comprised of a low acid (i.e. 16 weight percent acid or less) ionomer blend. Preferably, the inner layer is comprised of a blend of two or more low acid (i.e. 16 weight percent acid or less) ionomer resins neutralized to various extents by different metal cations. The inner cover layer may or may not include a metal stearate (e.g., zinc stearate) or other metal fatty acid salt. The purpose of the metal stearate or other metal fatty acid salt is to lower the cost of production without affecting the overall performance of the finished golf ball.

The low acid ionomers which may be suitable for use in formulating the inner layer compositions of the subject invention are ionic copolymers which are the metal, i.e., sodium, zinc, magnesium, etc., salts of the reaction product of an olefin having from about 2 to 8 carbon atoms and an unsaturated monocarboxylic acid having from about 3 to 8 carbon atoms. Preferably, the ionomeric resins are copolymers of ethylene and either acrylic or methacrylic acid.

In some circumstances, an additional comonomer such as an acrylate ester (i.e., iso- or n-butylacrylate, etc.) can also be included to produce a softer terpolymer. The carboxylic acid groups of the copolymer are partially neutralized (i.e., approximately 10-75%, preferably 30-70%) by the metal ions. Each of the low acid ionomer resins which may be included in the cover layer compositions of the invention contains 16% by weight or less of a carboxylic acid.

The inner layer compositions include the low acid ionomers such as those developed and sold by E. I. DuPont de Nemours & Company under the trademark Surlyn® and by Exxon Corporation under the trademarks Escor® or Iotek®, or blends thereof.

The low acid ionomeric resins available from Exxon under the designation Escor® and or Iotek®, are somewhat similar to the low acid ionomeric resins available under the Surlyn® trademark. However, since the Escor®/Iotek® ionomeric resins are sodium or zinc salts of poly(ethylene-acrylic acid) and the Surlyn® resins are zinc, sodium, magnesium, etc. salts of poly(ethylene-methacrylic acid), distinct differences in properties exist.

When utilized in the construction of the inner layer of a multi-layered golf ball, it has been found that the low acid ionomer blends extend the range of compression and spin rates beyond that previously obtainable. More preferably, it has been found that when two or more low acid ionomers, particularly blends of sodium and zinc high acid ionomers, are processed to produce the covers of multi-layered golf balls, (i.e., the inner cover layer herein) the resulting golf balls will travel further and at an enhanced spin rate than previously known multi-layered golf balls. Such an improvement is particularly noticeable in enlarged or oversized golf balls.

For example, the normal size, multi-layer golf ball taught in 4,650,193 does not incorporate blends of low acid ionomeric resins of the present invention in the inner cover layer. In addition, the multi-layered ball disclosed in the '193 patent suffers substantially in durability in comparison with the present invention.

Furthermore, as shown in the Examples, use of an inner layer formulated from blends of lower acid ionomers produces multi-layer golf balls

having enhanced compression and spin rates. These are the properties desired by the more skilled golfer.

With respect to the outer layer 16 of the multi-layered cover of the present invention, the outer cover layer is comparatively softer than the low acid ionomer blend based inner layer. The softness provides for the enhanced feel and playability characteristics typically associated with balata or balata-blend balls. The outer layer or ply, is comprised of a relatively soft, low modulus (about 1,000 psi to about 10,000 psi) and low acid (less than 16 weight percent acid) ionomer, ionomer blend or a non-ionomeric elastomer such as, but not limited to, a polyurethane, a polyester elastomer such as that marketed by DuPont under the trademark Hytrel®, a polyurethane sold by BASF under the designation Baytec® or a polyether amide such as that marketed by Elf Atochem S.A. under the trademark Pebax®. The outer layer is fairly thin (i.e. from about 0.010 to about 0.070 in thickness, more desirably 0.03 to 0.06 inches in thickness for a 1.680 inch ball and 0.04 to 0.07 inches in thickness for a 1.72 inch ball), but thick enough to achieve desired playability characteristics while minimizing expense.

Preferably, the outer layer includes a blend of hard and soft (low acid) ionomer resins such as those described in U. S. Patent Nos. 4,884,814 and 5,120,791, both incorporated herein by reference. Specifically, a desirable material for use in molding the cover layer comprises a blend of a high modulus (hard), low acid, ionomer with a low modulus (soft) low acid, ionomer to form a base ionomer mixture. A high modulus ionomer herein is one which measures from about 15,000 to about 70,000 psi as measured in accordance with ASTM method D-790. The hardness may be defined as at least 50 on the Shore D scale as measured in accordance with ASTM method D-2240.

A low modulus ionomer suitable for use in the outer layer blend has a flexural modulus measuring from about 1,000 to about 10,000 psi, with a hardness of about 20 to about 40 on the Shore D scale.

The hard ionomer resins utilized to produce the cover layer composition hard/soft blends include ionic copolymers which are the sodium, zinc, magnesium or lithium salts of the reaction product of an olefin having from 2 to 8 carbon atoms and an unsaturated monocarboxylic acid having from 3 to 8 carbon

atoms. The carboxylic acid groups of the copolymer may be totally or partially (i.e. approximately 15-75 percent) neutralized.

The hard ionomeric resins are likely copolymers of ethylene and either acrylic and/or methacrylic acid, with copolymers of ethylene and acrylic acid being the most preferred. Two or more types of hard ionomeric resins may be blended into the outer cover layer compositions in order to produce the desired properties of the resulting golf balls.

As discussed earlier herein, the hard ionomeric resins introduced under the designation Escor® and sold under the designation Iotek® are somewhat similar to the hard ionomeric resins sold under the Surlyn® trademark. However, since the Iotek® ionomeric resins are sodium or zinc salts of poly(ethylene-acrylic acid) and the Surlyn® resins are zinc or sodium salts of poly(ethylene-methacrylic acid) some distinct differences in properties exist. As more specifically indicated in the data set forth below, the hard Iotek® resins (i.e., the acrylic acid based hard ionomer resins) are the more preferred hard resins for use in formulating the cover layer blends for use in the present invention. In addition, various blends of Iotek® and Surlyn® hard ionomeric resins, as well as other available ionomeric resins, may be utilized in the present invention in a similar manner.

Examples of commercially available hard ionomeric resins which may be used in the present invention in formulating the inner and outer cover blends include the hard sodium ionic copolymer sold under the trademark Surlyn® 8940 and the hard zinc ionic copolymer sold under the trademark Surlyn® 9910. Surlyn® 8940 is a copolymer of ethylene with methacrylic acid and about 15 weight percent acid which is about 29 percent neutralized with sodium ions. This resin has an average melt flow index of about 2.8 gm/10 min. Surlyn® 9910 is a copolymer of ethylene and methacrylic acid with about 15 weight percent acid which is about 58 percent neutralized with zinc ions. The average melt flow index of Surlyn® 9910 is about 0.7 gm/10 min. The typical properties of Surlyn® 9910 and 8940 are set forth below in Table 1:

TABLE 1

Typical Properties of Commercially Available Hard Surlyn® Resins Suitable for Use in the Cover Layers of the Present Invention

	ASTM D	8940	9910	8920	8528	9970	9730
Cation Type		Sodium	Zinc	Sodium	Sodium	Zinc	Zinc
Melt flow index, gms/10 min.	D-1238	2.8	0.7	0.9	1.3	14.0	1.6
Specific Gravity, g/cm^3	D-792	0.95	0.97	0.95	0.94	0.95	0.95
Hardness, Shore D	D-2240	66	64	66	60	62	63
Tensile Strength, (kpsi), MPa	D-638	(4.8) 33.1	(3.6) 24.8	(5.4) 37.2	(4.2) 29.0	(3.2) 22.0	(4.1) 28.0
Elongation, %	D-638	470	290	350	450	460	460
Flexural Modulus, (kpsi) MPa	D-790	(51) 350	(48) 330	(55) 380	(32) 220	(28) 190	(30) 210
Tensile Impact (23°C) KJ/m^2 ($ft.-lbs./in^2$)	D-1822S	1020 (485)	1020 (485)	865 (410)	1160 (550)	760 (360)	1240 (590)
Vicat Softening Temperature, °C	D-1525	63	62	58	73	61	73

Examples of the more pertinent acrylic acid based hard ionomer resins suitable for use in the present inner and outer cover composition sold under the Iotek® trademark by the Exxon Corporation include Iotek® 4000, Iotek® 4010, Iotek® 8000, Iotek® 8020 and Iotek® 8030. The typical properties of these and other Iotek® hard ionomers suited for use in formulating the inner and outer layer cover composition are set forth below in Table 2:

TABLE 2

Typical Properties of Iotek® Ionomers

Resin Properties	ASTM Method	Units	4000	4010	8000	8020	8030
Cation type			zinc	zinc	sodium	sodium	sodium
Melt index	D-1238	g/10 min.	2.5	1.5	0.8	1.6	2.8
Density	D-1505	kg/m^3	963	963	954	960	960
Melting Point	D-3417	°C	90	90	90	87.5	87.5
Crystallization Point	D-3417	°C	62	64	56	53	55
Vicat Softening Point	D-1525	°C	62	63	61	64	67
% Weight Acrylic Acid			16		11		
% of Acid Groups cation neutralized			30		40		

Plaque Properties (3 mm thick, compression molded)	ASTM Method	Units	4000	4010	8000	8020	8030
Tensile at break	D-638	MPa	24	26	36	31.5	28
Yield point	D-638	MPa	none	none	21	21	23
Elongation at break	D-638	%	395	420	350	410	395
1% Secant modulus	D-638	MPa	160	160	300	350	390
Shore Hardness D	D-2240	--	55	55	61	58	59

Film Properties (50 micron film 2.2:1 Blow-up ratio)				4000	4010	8000	8020	8030
Tensile at Break	MD	D-882	MPa	41	39	42	52	47.4
	TD	D-882	MPa	37	38	38	38	40.5
Yield point	MD	D-882	MPa	15	17	17	23	21.6
	TD	D-882	MPa	14	15	15	21	20.7
Elongation at Break								
	MD	D-882	%	310	270	260	295	305
	TD	D-882	%	360	340	280	340	345
1% Secant modulus	MD	D-882	MPa	210	215	390	380	380
	TD	D-882	MPa	200	225	380	350	345
Dart Drop Impact		D-1709	g/micron	12.4	12.5	20.3		

Resin Properties Cation type	ASTM Method	Units	7010 zinc	7020 zinc	7030 zinc
Melt Index	D-1238	g/10 min.	0.8	1.5	2.5
Density	D-1505	kg/m^3	960	960	960
Melting Point	D-3417	°C	90	90	90
Vicat Softening Point	D-1525	°C	60	63	62.5
Plaque Properties (3 mm thick, compression molded)	ASTM Method	Units	7010	7020	7030
Tensile at break	D-638	MPa	38	38	38
Yield Point	D-638	MPa	none	none	none
Elongation at break	D-638	%	500	420	395
Shore Hardness D	D-2240	--	57	55	55

Comparatively, soft ionomers may be used in formulating the hard/soft blends of the inner and outer cover compositions. These ionomers include acrylic acid based soft ionomers. They are generally characterized as comprising sodium or zinc salts of a terpolymer of an olefin having from about 2 to 8 carbon atoms, acrylic acid, and an unsaturated monomer of the acrylate ester class having from 1 to 21 carbon atoms. The soft ionomer is preferably a zinc based ionomer made from an acrylic acid base polymer in an unsaturated monomer of the acrylate ester class. The soft (low modulus) ionomers have a hardness from about 20 to about 40 as measured on the Shore D scale and a flexural modulus from about 1,000 to about 10,000, as measured in accordance with ASTM method D-790.

Certain ethylene-acrylic acid based soft ionomer resins developed by the Exxon Corporation under the designation Iotek® 7520 (referred to experimentally by differences in neutralization and melt indexes as LDX 195, LDX 196, LDX 218 and LDX 219) may be combined with known hard ionomers such as those indicated above to produce the inner and outer cover layers. The combination produces higher C.O.R.s at equal or softer hardness, higher melt flow (which corresponds to improved, more efficient molding, i.e., fewer rejects) as well as significant cost savings versus the outer layer of multi-layer balls produced by

other known hard-soft ionomer blends as a result of the lower overall raw materials costs and improved yields.

While the exact chemical composition of the resins to be sold by Exxon under the designation Iotek® 7520 is considered by Exxon to be confidential and proprietary information, Exxon's experimental product data sheet lists the following physical properties of the ethylene acrylic acid zinc ionomer developed by Exxon:

TABLE 3

Physical Properties of Iotek® 7520

Property	ASTM Method	Units	Typical Value
Melt Index	D-1238	g/10 min.	2
Density	D-1505	kg/m^3	0.962
Cation			Zinc
Melting Point	D-3417	°C	66
Crystallization Point	D-3417	°C	49
Vicat Softening Point	D-1525	°C	42
Plaque Properties (2 mm thick Compression Molded Plaques)			
Tensile at Break	D-638	MPa	10
Yield Point	D-638	MPa	None
Elongation at Break	D-638	%	760
1% Secant Modulus	D-638	MPa	22
Shore D Hardness	D-2240		32
Flexural Modulus	D-790	MPa	26
Zwick Rebound	ISO 4862	%	52
De Mattia Flex Resistance	D-430	Cycles	>5000

In addition, test data collected by the Assignee indicates that Iotek® 7520 resins have Shore D hardnesses of about 32 to 36 (per ASTM D-2240), melt flow indexes of 3±0.5 g/10 min (at 190°C. per ASTM D-1288), and a flexural modulus of about 2500-3500 psi (per ASTM D-790). Furthermore, testing by an independent testing laboratory by pyrolysis mass spectrometry indicates that

Iotek® 7520 resins are generally zinc salts of a terpolymer of ethylene, acrylic acid, and methyl acrylate.

Furthermore, it has been found that a grade of an acrylic acid based soft ionomer available from the Exxon Corporation under the designation Iotek® 7510, is also effective, when combined with the hard ionomers indicated above in producing golf ball covers exhibiting higher C.O.R. values at equal or softer hardness than those produced by known hard-soft ionomer blends. In this regard, Iotek® 7510 has the advantages (i.e. improved flow, higher C.O.R. values at equal hardness, increased clarity, etc.) produced by the Iotek® 7520 resin when compared to the methacrylic acid base soft ionomers known in the art (such as the Surlyn® 8625 and the Surlyn® 8629 combinations disclosed in U.S. Patent No. 4,884,814).

In addition, Iotek® 7510, when compared to Iotek® 7520, produces slightly higher C.O.R. valves at equal softness/hardness due to the Iotek® 7510's higher hardness and neutralization. Similarly, Iotek® 7510 produces better release properties (from the mold cavities) due to its slightly higher stiffness and lower flow rate than Iotek® 7520. This is important in production where the soft covered balls tend to have lower yields caused by sticking in the molds and subsequent punched pin marks from the knockouts.

According to Exxon, Iotek® 7510 is of similar chemical composition as Iotek® 7520 (i.e. a zinc salt of a terpolymer of ethylene, acrylic acid, and methyl acrylate) but is more highly neutralized. Based upon FTIR analysis, Iotek® 7520 is estimated to be about 30-40 wt.-% neutralized and Iotek® 7510 is estimated to be about 40-60 wt.-% neutralized. The typical properties of Iotek® 7510 in comparison of those of Iotek® 7520 are set forth below:

TABLE 4

Physical Properties of Iotek® 7510
in Comparison to Iotek® 7520

	IOTEK® 7520	IOTEK® 7510
MI, g/10 min	2.0	0.8
Density, g/cc	0.96	0.97
Melting Point, °F	151	149
Vicat Softening Point, °F	108	109
Flex Modulus, psi	3800	5300
Tensile Strength, psi	1450	1750
Elongation, %	760	690
Hardness, Shore D	32	35

It has been determined that when high acid/low acid ionomer blends are used for the cover layers, good results are achieved when the relative combination is in a range of about 90 to about 10 percent hard ionomer and about 10 to about 90 percent soft ionomer. The results are improved by adjusting the range to about 75 to 25 percent hard ionomer and 25 to 75 percent soft ionomer. Even better results are noted at relative ranges of about 60 to 90 percent hard ionomer resin and about 40 to 60 percent soft ionomer resin.

Specific formulations which may be used in the cover composition are included in the examples set forth in U. S. Patent No. 5,120,791 and 4,884,814. The present invention is in no way limited to those examples.

Moreover, in alternative embodiments, the outer cover layer formulation may also comprise a soft, low modulus non-ionomeric thermoplastic elastomer including a polyester polyurethane such as B.F.Goodrich Company's Estane® polyester polyurethane X-4517. According to B.F.Goodrich, Estane® X-4517 has the following properties:

Properties of Estane® X-4517

Tensile	1430
100%	815
200%	1024
300%	1193
Elongation	641
Youngs Modulus	1826

Hardness A/D	88/39
Dayshore Rebound	59
Solubility in Water	Insoluble
Melt processing temperature	>350°F (>177°C)
Specific Gravity (H_2O=1)	1.1-1.3

Other soft, relatively low modulus non-ionomeric thermoplastic elastomers may also be utilized to produce the outer cover layer as long as the non-ionomeric thermoplastic elastomers produce the playability and durability characteristics desired without adversely effecting the enhanced characteristics produced by the low acid ionomer resin composition. These include, but are not limited to thermoplastic polyurethanes such as: Texin® thermoplastic polyurethanes from Mobay Chemical Co. and the Pellethane® thermoplastic polyurethanes from Dow Chemical Co.; Ionomer/rubber blends such as those in Spalding U.S. Patents 4,986,545; 5,098,105 and 5,187,013; and, Hytrel® polyester elastomers from DuPont and Pebax® polyetheramides from Elf Atochem S.A.

Similarly, a castable, thermosetting polyurethane produced by BASF under the trade designation Baytec® has also shown enhanced cover formulation properties. According to BASF, Baytec® (such as Baytec® RE 832), relates to a group of reactive elastomers having outstanding wear resistance, high mechanical strength, high elasticity and good resistance to weathering, moisture and chemicals. The Baytec® RE-832 system gives the following typical physical properties:

Property	ASTM Test Method	Unit	Value
Tear Strength Die C	D624	psi	180
Stress at			
100% Modulus	D412	psi	320
200% Modulus			460
300% Modulus			600
Ultimate Strength	D412	psi	900
Elongation at Break	D412	%	490
Taber Abrasion	D460, H-18	mg/1000 cycles	350

Component[1] Properties	Part A (Isocyanate)	Part B (Resin)
Viscosity @ 25°C, mPa·s	2500	2100
Density @ 25°C, g/cm	1.08	1.09
NCO, %	9.80	----------
Hydroxyl Number, Mg KOH/g	----------	88

[1]Component A is a modified diphenylmethane diisocyanate (MDI) prepolymer and component B is a polyether polyol blend.

In preparing golf balls in accordance with the present invention, a hard inner cover layer is molded (by injection molding or by compression molding) about a core (preferably a solid core). A comparatively softer outer layer is molded over the inner layer.

The conventional solid core is about 1.545 inches in diameter, although it can range from about 1.495 to about 1.575 inches. Conventional solid cores are typically compression molded from a slug of uncured or lightly cured elastomer composition comprising a high cis content polybutadiene and a metal salt of an α, β, ethylenically unsaturated carboxylic acid such as zinc mono or diacrylate or methacrylate. To achieve higher coefficients of restitution in the core, the manufacturer may include fillers such as small amounts of a metal oxide such as zinc oxide. In addition, larger amounts of metal oxide than those that are needed to achieve the desired coefficient are often included in conventional cores in order to increase the core weight so that the finished ball more closely approaches the U.S.G.A. upper weight limit of 1.620 ounces. Other materials may be used in the core composition including compatible rubbers or ionomers, and low molecular weight fatty acids such as stearic acid. Free radical initiators such as peroxides are admixed with the core composition so that on the application of heat and pressure, a complex curing cross-linking reaction takes place.

The inner cover layer which is molded over the core is about 0.100 inches to about 0.010 inches in thickness, preferably about 0.0375 inches thick. The outer cover layer is about 0.010 inches to about 0.050 inches in thickness, preferably 0.0300 inches thick. Together, the core, the inner cover layer and the outer cover layer combine to form a ball having a diameter of 1.680 inches or

more, the minimum diameter permitted by the rules of the United States Golf Association and weighing about 1.620 ounces.

Additional materials may be added to the cover compositions (both inner and outer cover layer) of the present invention including dyes (for example, Ultramarine Blue sold by Whitaker, Clark and Daniels of South Plainsfield, N.J.) (see U.S. Patent No. 4,679,795); pigments such as titanium dioxide, zinc oxide, barium sulfate and zinc sulfate; and UV absorbers; antioxidants; antistatic agents; and stabilizers. Further, the cover compositions of the present invention may also contain softening agents, such as plasticizers, processing aids, etc. and reinforcing material such as glass fibers and inorganic fillers, as long as the desired properties produced by the golf ball covers are not impaired.

The various cover composition layers of the present invention may be produced according to conventional melt blending procedures. In the case of the outer cover layer, when a blend of hard and soft, low acid ionomer resins are utilized, the hard ionomer resins are blended with the soft ionomeric resins and with a masterbatch containing the desired additives in a Banbury mixer, two-roll mill, or extruder prior to molding. The blended composition is then formed into slabs and maintained in such a state until molding is desired. Alternatively, a simple dry blend of the pelletized or granulated resins and color masterbatch may be prepared and fed directly into the injection molding machine where homogenization occurs in the mixing section of the barrel prior to injection into the mold. If necessary, further additives such as an inorganic filler, etc., may be added and uniformly mixed before initiation of the molding process. A similar process is utilized to formulate the high acid ionomer resin compositions used to produce the inner cover layer.

The golf balls of the present invention can be produced by molding processes currently well known in the golf ball art. Specifically, the golf balls can be produced by injection molding or compression molding the inner cover layer about wound or solid molded cores to produce an intermediate golf ball having a diameter of about 1.50 to 1.67 inches, preferably about 1.620 inches. The outer layer is subsequently molded over the inner layer to produce a golf ball having a diameter of 1.680 inches or more. Although either solid cores or wound cores can

be used in the present invention, as a result of their lower cost and superior performance, solid molded cores are preferred over wound cores.

In compression molding, the inner cover composition is formed via injection at about 380°F to about 450°F into smooth surfaced hemispherical shells which are then positioned around the core in a mold having the desired inner cover thickness and subjected to compression molding at 200° to 300°F for about 2 to 10 minutes, followed by cooling at 50°to 70°F for about 2 to 7 minutes to fuse the shells together to form a unitary intermediate ball. In addition, the intermediate balls may be produced by injection molding wherein the inner cover layer is injected directly around the core placed at the center of an intermediate ball mold for a period of time in a mold temperature of from 50°F to about 100°F. Subsequently, the outer cover layer is molded about the core and the inner layer by similar compression or injection molding techniques to form a dimpled golf ball of a diameter of 1.680 inches or more.

After molding, the golf balls produced may undergo various further processing steps such as buffing, painting and marking as disclosed in U.S. Patent No. 4,911,451.

The resulting golf ball produced from the low acid ionomer resin inner layer and the relatively softer, low flexural modulus outer layer provide for an improved multi-layer golf ball which provides for desirable coefficient of restitution and durability properties while at the same time offering the feel and spin characteristics associated with soft balata and balata-like covers of the prior art.

The present invention is further illustrated by the following examples in which the parts of the specific ingredients are by weight. It is to be understood that the present invention is not limited to the examples, and various changes and modifications may be made in the invention without departing from the spirit and scope thereof.

Example 1

Several intermediate balls (cores plus inner cover layers) were prepared in accordance with conventional molding procedures described above. The inner cover compositions were molded around 1.545 inch diameter cores

weighing 36.5 grams such that the inner cover had a wall thickness of about 0.0675 inches, with the overall ball measuring about 1.680 inches in diameter.

The cores utilized in the examples were comprised of the following ingredients: high cis-polybutadiene, zinc diacrylate, zinc oxide, zinc stearate, peroxide, calcium carbonate, etc. The molded cores exhibited Riehle compressions of about 60 and C.O.R. values of about .800. A representative formulation of the molded cores is set forth below:

MATERIAL	WEIGHT
BR-1220 (high cis-polybutadiene)	70.70
Taktene® 220 (high cis-polybutadiene)	29.30
React Rite™ ZDA (zinc diacrylate)	31.14
Zinc Oxide	6.23
Zinc Stearate	20.15
Limestone	17.58
Ground Flash (20-40 Mesh)	20.15
Blue Masterbatch	.012
Luperco® 231XL or Trigonox® 29/40	.89
Papi® 94	.50

†Blue Masterbatch consists of unknown compositions used only for internal identification purposes and has no effect on physical properties.

The inner cover compositions designated herein as compositions A-E utilized to formulate the intermediate balls are set forth in Table 7 below. The resulting molded intermediate balls were tested to determine the individual compression (Riehle), C.O.R., Shore C hardness, spin rate and cut resistance properties. These results are also set forth in Table 7 below.

The data of these examples are the average of twelve intermediate balls produced for each example. The properties were measured according to the following parameters:

Coefficient of restitution (C.O.R.) was measured by firing the resulting golf ball in an air cannon at a velocity of 125 feet per second against a steel plate. The rebound velocity was then measured. The rebound velocity was divided by the forward velocity to give a coefficient of restitution. Details for this

procedure are set forth in U.S. Patent 5,984,806, herein incorporated by reference.

Shore hardness was measured generally in accordance with ASTM test 2240.

Cut resistance was measured in accordance with the following procedure: A golf ball is fired at 135 feet per second against the leading edge of a pitching wedge wherein the leading edge radius is 1/32 inch, the loft angle is 51 degrees, the sole radius is 2.5 inches and the bounce angle is 7 degrees.

The cut resistance of the balls tested herein was evaluated on a scale of 1 to 5. The number 1 represents a cut that extends completely through the cover to the core. A 2 represents a cut that does not extend completely through he cover but that does break the surface. A 3 does not break the surface of the cover but does leave a permanent dent. A 4 leaves only a slight crease which is permanent but not as severe as 3. A 5 represents virtually no visible indentation or damage of any sort.

The spin rate of the golf ball was measured by striking the resulting golf balls with a pitching wedge or 9 iron wherein the club head speed is about 105 feet per second and the ball is launched at an angle of 26 to 34 degrees with an initial velocity of about 110 to 115 feet per second. The spin rate was measured by observing the rotation of the ball in flight using stop action Strobe photography.

Initial velocity is the velocity of a ball when struck at a hammer speed of 143.8 feet per second in accordance with a test as prescribed by the U.S.G.A.

As will be noted, compositions A, B and C include high acid ionomeric resins (16% or more acid), with composition B further including zinc stearate. Composition D represents the inner layer (i.e. Surlyn® 1605) used in U.S. Patent No. 4,431,193. Composition E provides a hard, low acid ionomeric resin blend.

The purpose behind producing and testing the balls of Table 11 was to provide a subsequent comparison in properties with the multi-layer golf balls of the present invention.

Table 5

Molded Intermediate Golf Balls

Ingredients of Inner Cover Compositions	A	B	C	D	E
Iotek® 959	50	50	--	--	--
Iotek® 960	50	50	--	--	--
Zinc Stearate	--	50	--	--	--
Surlyn® 8162	--	--	75	--	--
Surlyn® 8422	--	--	25	--	--
Surlyn® 1605	--	--	--	100	--
Iotek® 7030	--	--	--	--	50
Iotek® 8000	--	--	--	--	50
Properties of Molded Intermediate Balls					
Compression	58	58	60	63	62
C.O.R.	.811	.810	.807	.793	.801
Shore C Hardness	98	98	97	96	96
Spin Rate (R.P.M.)	7,367	6,250	7,903	8,337	7,956
Cut Resistance	4-5	4-5	4-5	4-5	4-5

As shown in Table 5 above, the high acid ionomer resin inner cover layer (molded intermediate balls A-C) have lower spin rates and exhibit higher resiliency characteristics than the low acid ionomer resin based inner cover layers of balls D and E.

Multi-layer balls in accordance with the present invention were then prepared. Specifically, the inner cover compositions used to produce intermediate golf balls from Table 5 were molded over the solid cores to a thickness of about 0.0375 inches, thus forming the inner layer. The diameter of the solid core with the inner layer measured about 1.620 inches. Alternatively, the intermediate golf balls of Table 5 were ground down using a centerless grinding machine to a size of 1.620 inches in diameter to produce an inner cover layer of 0.0375 inches.

The size of 1.620 inches was determined after attempting to mold the outer cover layer to various sizes (1.600", 1.610", 1.620", 1.630" and 1.640") of intermediate (core plus inner layer) balls. It was determined that 1.620" was about the largest "intermediate" ball (i.e., core plus inner layer) which could be easily molded over with the soft outer layer materials of choice. The goal herein was to use as thin an outer layer as necessary to achieve the desired playability characteristics while minimizing the cost of the more expensive outer materials.

However, with a larger diameter final golf ball and/or if the cover is compression molded, a thinner cover becomes feasible.

With the above in mind, an outer cover layer composition was blended together in accordance with conventional blending techniques. The outer layer composition used for this portion of the example is a relatively soft cover composition such as those listed in U.S. Patent No. 5,120,791. An example of such a soft cover composition is a 45% soft/55% hard low acid ionomer blend designated by the inventor as "TE-90". The composition of TE-90 is set forth below in Table 12 as follows:

Outer Cover Layer Composition TE-90

Iotek® 8000	22.7 weight %
Iotek® 7030	22.7 weight %
Iotek® 7520	45.0 weight %
White MB[1]	9.6 weight %

[1]White MB consists of about 23.77 weight percent TiO_2; 0.22 weight percent Uvitex® OB, 0.03 weight percent Santonox® R, 0.05 weight percent Ultramarine Blue™ and 75.85 weight percent Iotek® 7030.

The above outer layer composition was molded around each of the 1.620 diameter intermediate balls comprising a core plus one of compositions A-D, respectively. In addition, for comparison purposes, Surlyn® 1855 (new Surlyn® 9020), the cover composition of the '193 patent, was molded about the inner layer of composition D (the intermediate ball representative of the '193 patent). The outer layer TE-90 was molded to a thickness of approximately 0.030 inches to produce a golf ball of approximately 1.680 inches in diameter. The resulting balls (a dozen balls for each example) were tested and the various properties thereof are set forth in Table 6A as follows:

TABLE 6A

Finished Balls

Ingredients:	1	2	3	4	5
Inner Cover Composition	A	B	C	D	D
Outer Cover Composition	TE-90	TE-90	TE-90	TE-90	Surlyn® 9020
Properties of Molded Finished Balls:					
Compression	63	63	69	70	61
C.O.R.	.784	.778	.780	.770	.757
Shore C Hardness	88	88	88	88	89
Spin (R.P M.)	8,825	8,854	8,814	8,990	8,846
Cut Resistance	3-4	3-4	3-4	3-4	1-2

As it will be noted in finished balls 1-4, by creating a multi-layer cover utilizing the high acid ionomer resins in the inner cover layer and the hard/soft low acid ionomer resin in the outer cover layer, generally higher compression and increased spin rates are noted over the single layer covers of Table 11. In addition, both the C.O.R. and the Shore C hardness are reduced over the respective single layer covers of Table 11. This was once again particularly true with respect to the multi-layered balls containing the high acid ionomer resin in the inner layer (i.e. finished balls 1-4). In addition, with the exception of prior art ball 5 (i.e. the '193 patent), resistance to cutting remains good but is slightly decreased. As noted above, the prior art ball of the '193 patent suffers substantially in durability (as well as in resiliency) in comparison to the balls of the present invention.

Furthermore, it is also noted that the use of the high acid ionomer resins as the inner cover material produces a substantial increase in the finished balls' overall distance properties. In this regard, the high acid ionomer resin inner covers of balls 1-3 produce an increase of approximately 10 points in C.O.R. over the low acid ionomer resin inner covers of balls 4 and about a 25 point increase over the prior art balls 5. Since an increase in 3 to 6 points in C.O.R. results in an

average increase of about 1 yard in distance, such an improvement is deemed to be significant.

Several other outer layer formulations were prepared and tested by molding them around the core and inner cover layer combination to form balls each having a diameter of about 1.68 inches. First, B.F.Goodrich Estane® X-4517 polyester polyurethane was molded about the core molded with inner layer cover formulation A. DuPont Surlyn® 9020 was molded about the core which was already molded with inner layer D. Similar properties tests were conducted on these golf balls and the results are set forth in Table 6B below:

TABLE 6B

Finished Balls

Ingredients.	6	7
Inner Cover Layer Composition	A	D
Outer Cover Layer Composition	Estane® 4517	Surlyn® 9020
Properties of Molded Finished Balls:		
Compression	67	61
C.O.R.	.774	.757
Shore C Hardness	74	89
Spin (R.P.M.)	10,061	8,846
Cut Resistance	3-4	1-2

The ball comprising inner layer formulation D and Surlyn® 9020 identifies the ball in the Nesbitt 4,431,193 patent. As is noted, the example provides for relatively high softness and spin rate though it suffers from poor cut resistance and low C.O.R. This ball is unacceptable by today's standards.

As for the Estane® X-4517 polyester polyurethane, a significant increase in spin rate over the TE-90 cover is noted along with an increased compression. However, the C.O.R. and Shore C values are reduced, while the cut resistance remains the same. Furthermore, both the Estane® X-4517 polyester polyurethane and the Surlyn® 9020 were relatively difficult to mold in such thin sections.

Example 2

In order to analyze the change in characteristics produced by multi-layer golf balls (standard size) having inner cover layers comprised of ionomer resin blends of different acid levels, a series of experiments were run. Specifically, 14 tests were performed, varying the type of core, inner cover layer and outer cover layer. The results are shown below:

TABLE 7

Sample #	Core	INNER LAYER	THICKNESS	COMP/ COR	OUTER COVER	THICKNESS	COMP (Rhiele)	COR	SHORE D	SPIN
8	1042 YELLOW	NONE	-----	SEE BELOW	TOP GRADE	0.055	61	.800	68	7331
9	1042 YELLOW	NONE	---------	SEE BELOW	959/960	0 055"	56	.808	73	6516
10	SPECIAL 1.47"	959/960	0/050"	65/.805	959/960	O 055"	48	.830	73	6258
11	1042 YELLOW	NONE	---------	SEE BELOW	SD 90	0.055"	62	.792	63	8421
12	SPECIAL 1.47"	TOP GRADE	0.050"	66/.799	SD 90	0.055"	55	.811	63	8265
13	SPECIAL 1 47"	959/960	0.050"	65/.805	SD 90	0.055"	53	813	63	8254
14	SPECIAL 1.47"	TOP GRADE	0.050"	66/.799	TOP GRADE	0.055"	51	819	68	7390
15	1042 YELLOW	NONE	-------	SEE BELOW	Z-BALATA	0.055"	67	.782	55	9479
16	SPECIAL 1.47"	959/960	0.050"	65/ 805	Z-BALATA	0.055"	61	.800	55	9026
17	SPECIAL 1.47"	TOP GRADE	0.050"	66/ 799	Z-BALATA	0 055"	60	.798	55	9262

1042 YELLOW>COMP=72, COR=.780
SPECIAL 1.47" CORE>COMP=67, COR=.782

In this regard, Top Grade or TG is a low acid inner cover ionomer resin blend comprising of 70.6% Iotek® 8000, 19.9% Iotek® 7010 and 9.6% white masterbatch. "959/960" is a 50/50 wt/wt blend of Iotek® 959/960. In this regard, Escor® or Iotek® 959 is a sodium ion neutralized ethylene-acrylic neutralized ethylene-acrylic acid copolymer. According to Exxon, Iotek® 959 and 960 contain from about 19.0 to about 21.0% by weight acrylic acid with approximately 30 to about 70 percent of the acid groups neutralized with sodium and zinc ions, respectively. The physical properties of these high acid acrylic acid based ionomers are as follows:

PROPERTY	ESCOR® (IOTEK®) 959	ESCOR® (IOTEK®) 960
Melt Index, g/10 min	2.0	1.8
Cation	Sodium	Zinc
Melting Point, °F	172	174
Vicat Softening Point, °F	130	131
Tensile @ Break, psi	4600	3500
Elongation @ Break, %	325	430
Hardness, Shore D	66	57
Flexural Modulus, psi	66,000	27,000

Furthermore, the low acid ionomer formulation for SD 90 and Z-Balata are set forth below:

SD Cover	ZB Cover
17.2% Surlyn® 8320	19% Iotek® 8000
7.5% Surlyn® 8120	19% Iotek® 7030
49% Surlyn® 9910	52.5% Iotek® 7520
16.4% Surlyn® 8940	9.5% white MB
9.7% white MB	

The data clearly indicates that higher C.O.R. and hence increased travel distance can be obtained by using multi-layered covered balls versus balls covered with single layers. However, some sacrifices in compression and spin are also noted. Further, as shown in comparing Example Nos. 12 vs. 13, Example

Nos. 17 vs. 16, etc., use of lower acid level inner cover layers and relatively soft outer cover layers (i.e., 50 wt. % or more soft ionomer) produces softer compression and higher spin rates than the golf balls comprised of high acid inner cover layers. Consequently, use of blends of low acid ionomer resins to produce the inner layer of a multi-layer covered golf ball produces not only enhanced travel distance but also enhanced compression and spin properties.

Example 3

Multi-layer oversized golf balls were produced utilizing different ionomer resin blends as the inner cover layer (i.e., core plus inner cover layer is defined as "mantel"). The "ball data" of the oversized multi-layer golf balls in comparison with production samples of Top-Flite® XL and Top-Flite® Z-Balata is set forth below.

TABLE 8

	18	19	20	21 Top-Flite® XL	22 Top-Flite® Z-Balata 90
Core Data					
Size	1.43	1.43	1.43	1.545	1.545
COR	.787	787	.787	----	----
Mantle Data					
Material	TG	TG	TG	----	----
Size	1.61	1.61	1.61	----	----
Thickness	.090	.090	.090	----	----
Shore D	68	68	68	----	----
Compression	57	57	57	----	----
COR	.815	815	.815	----	----
Ball Data					
Cover	TG	ZB	SD	TG	ZB
Size	1.725	1.723	1.726	1.681	1.683
Weight	45.2	45.1	45.2	45.3	45.5
Shore D	68	56	63	68	56
Compression	45	55	49	53	77
COR	.820	.800	810	809	.797
Spin	7230	9268	8397	7133	9287

The results indicate that use of multi-layer covers enhances C.O.R. and travel distance. Further, the data shows that use of a blend of low acid ionomer resins (i.e., Top Grade) to form the inner cover layer in combination with a soft outer cover (ZB or SD) produces enhanced spin and compression characteristics. The overall combination results in a relatively optimal golf ball with respect to characteristics of travel distances, spin and durability.

Example 4

Castable Polyurethane Covered Multi-layer Balls

A limited number of samples were made using BASF Baytec® RE232 polyurethane as a cover material over four different types of mantle cores. Controls included Z-Balata 100s along with the same mantle cores used for the polyurethane samples covered with Z-Balata cover stock. Mantle cores were made up of 82 and 58 compression cores covered with Iotek® 8030/7030.

Castable PU Molding Process

Materials used:

Baytec® RE832, mix ratio 9 parts A/12 parts B
1 - 1.57" i.d. smooth cavity
2 - 1.68" i.d. dimpled cavities
1 - 2" hose clamp
1 - bench vise or large C-clamp

(The smooth and dimpled cavities are the same O.D.)

The mantle core is 1.57" and fits snugly in the 1.57" cavity. The hose clamp is attached to the 1.57" cavity and a mantle core is placed inside. Urethane is mixed and poured into one of the dimpled cavities and the two halves are placed together and clamped, forcing out excess material and forming half the cover. The hose clamp is used to keep the two mold halves aligned during curing. When the cover material is set up enough (about 5 minutes), the two halves are separated and the 1.57" mold is replaced with the other 1.68" mold and the process is repeated. Both halves of the cover are now cast and the entire assembly is placed in an 125°F oven for 1 hour after which it can be opened and the ball removed.

All samples were finished using normal production equipment and procedures. The properties of the finished balls are set forth below:

TABLE 9

	23	24	25	26	27	28	29	30
Core Data								
Size	1.47"	1.47"	1.47"	1.47"	1.47	1.47"	1.47"	1.47"
Weight	32.2	32	32.2	32	37.7	32.2	32	32.2
Comp	82	58	82	58	85	82	58	82
COR	768	772	768	772	794	768	772	768
Mantle Data	Iotek®	Iotek®	Iotek®	Iotek®		Iotek®	Iotek®	Iotek®
Material	8030/7030	8030/7030	8030/7030	8030/7030	None	8030/7030	8030/7030	8030/7030
Weight	37.8	38.1	37.9	38.1		37.8	38.1	37.9
Size	1.57"	1.57"	1.57"	1.57"		1.57"	1.57"	1.57"
Comp	70	48	69	48		70	48	69
COR	781	785	786	788		781	785	786
Ball Data								
Cover Material	Baytec® RE832	Baytec® RE832	Baytec® RE832	Baytec® RE832	Z-Balata	Z-Balata	Z-Balata	Z-Balata
Weight	45.4	45.5	45.5	45.2	45.3	44.8	45	
Comp	75	64	73	60	80	66	50	65
COR	771	763	770	761	792	775	774	778
Shore C	65	65	65	65	84	84	84	84
Spin (rpm)	9560	8789	9285	8760	8796	8702	9072	8643
Cut (1-good, 4-poor)	2	2	2	1.5	2	2	2	2
Scuff (1-good, 4-poor)	1.5	1.5	1.5	1.5	2	3	3	3

Table 9 contains the construction details and test results. Multilayer balls with the thermoset urethane covers (Examples 23-25) were softer in compression and similar in COR to the multi-layer balls with the Z-Balata cover (Examples 27-29). Shore C was much lower for the urethane balls and they were more resistant to scuff than any of the Z-Balata covered balls. Guillotine cut resistance was about the same. Spin rate comparison shows that the urethane samples are better than the Z-Balata covered balls.

Test results indicate that a very good multi-layer ball can be made using castable polyurethane cover material. Further, advantages include the molding of very thin covers, molding over very soft compression core/mantle, and low cost tooling.

The invention has been described with reference to the preferred embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

I claim:

1. A golf ball comprising:

a core;

an inner cover layer disposed on said core, said inner cover layer having a Shore D hardness of at least 60, said inner cover layer comprising a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and

an outer cover layer disposed on said inner cover layer, said outer cover layer having a Shore D hardness of from about 55 to about 59, a thickness of from about 0.01 to about 0.07 inches, and comprising a polyurethane material.

2. The golf ball of claim 1 wherein said outer cover exhibits a Shore D hardness of from about 56 to about 58.

3. The golf ball of claim 1 wherein said outer cover exhibits a Shore D hardness of about 57.

4. The golf ball of claim 1 wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.

5. The golf ball of claim 1 wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.

6. A golf ball comprising:

a core;

an inner cover layer disposed about said core, said inner cover layer having a Shore D hardness of at least 60, said inner cover layer comprising a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and

an outer cover layer disposed on said inner cover layer, said outer cover layer having a Shore D hardness of from about 60 to about 68, a thickness of from about 0.01 to about 0.07 inches, and comprising a polyurethane material.

7. The golf ball of claim 6 wherein said outer cover exhibits a Shore D hardness of from about 62 to about 66.

8. The golf ball of claim 6 wherein said outer cover exhibits a Shore D hardness of from about 63 to about 64.

9. The golf ball of claim 6 wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.

10. The golf ball of claim 6 wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.

11. A golf ball comprising:

a core;

an inner cover layer disposed on said core, said inner cover layer having a Shore D hardness of about 60 or more, said inner cover layer comprising an ionomeric resin including no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid and having a modulus of from about 15,000 to about 70,000 psi; and

an outer cover layer disposed about said inner cover layer, said outer cover layer having a Shore D hardness of from about 55 to about 68, a thickness of from about 0.01 to about 0.07 inches, and comprising a polyurethane material.

12. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of from about 56 to about 58.

13. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of about 57.

14. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of from about 62 to about 66.

15. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of from about 63 to about 64.

16. The golf ball of claim 11 wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.

17. The golf ball of claim 11 wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.

GOLF BALL HAVING MULTI-LAYER COVER WITH UNIQUE OUTER COVER CHARACTERISTICS

ABSTRACT

The present invention is directed to an improved multi-layer golf ball comprising a core, an inner cover layer and an outer cover layer. The inner cover layer is comprised of a low acid ionomer blend which may or may not include a filler such as zinc-stearate. The outer cover layer is comprised of a soft, non-ionomeric thermoplastic or thermosetting elastomer such as polyurethane, polyester or polyesteramide. The resulting multi-layered golf ball of the present invention provides for enhanced distance without sacrificing playability or durability when compared to known multi-layer golf balls.

C:\DATA\MEB\APPLNS\SLD20353.111

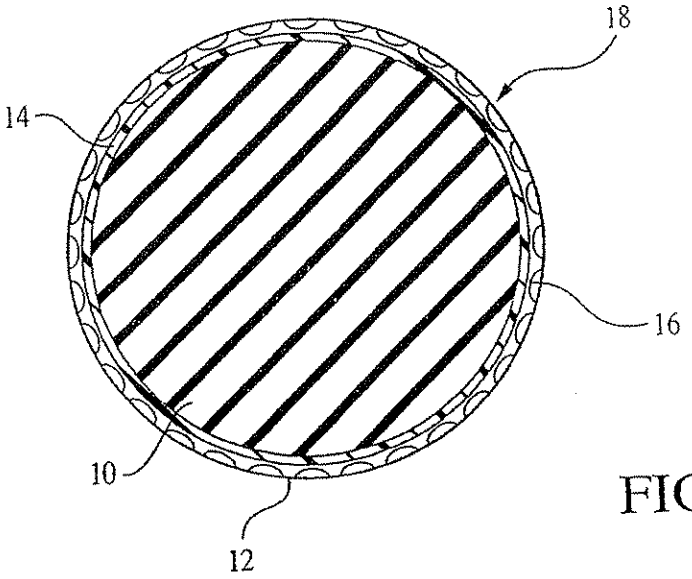


FIG. 1

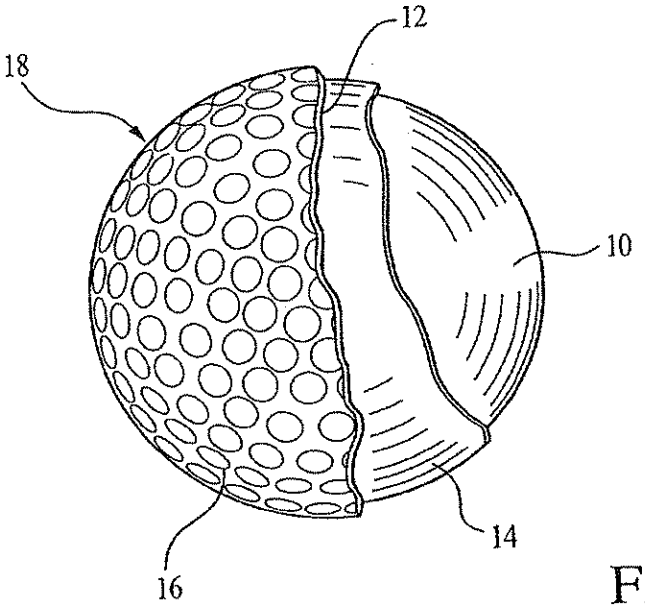


FIG. 2

Docket No.: P-3724-2/SLD 2 035-3-3

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am an original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

IMPROVED MULTI-LAYER GOLF BALL

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37 Code of Federal Regulations § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

None

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Donald R. Bahr, Reg. No. 21,011
Christopher B. Fagan, Reg. No. 22,987
Richard M. Klein, Reg. No. 33,000

Address all telephone calls to: Richard M. Klein
at telephone number: (216) 861-5582
Address all correspondence to:

Donald R. Bahr, Esq.
SPALDING & EVENFLO COMPANIES, INC.
5730 North Hoover Boulevard
Tampa, Florida 33634

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Michael J. Sullivan

Inventor's signature Michael J Sullivan

Date: October 31, 1995

Residence: 58 Marlborough Street
Chicopee, Massachusetts 01021

Citizenship: U.S.A.

Post Office Address: 58 Marlborough Street
Chicopee, Massachusetts 01021

09/873642 06/04/01

Class	Subclass	ISSUE CLASSIFICATION
473	374	

PATENT NUMBER
6503156
6503156

U.S. UTILITY Patent Application

O.I.P.E.	PATENT DATE
SCANNED HC 11 Q.A. HC 4	JAN 07 2003

APPLICATION NO.	CONT/PRIOR	CLASS	SUBCLASS	ART UNIT	EXAMINER
09/873642	D	473	374	3711	GARREN

APPLICANTS: Michael Sullivan

TITLE: Golf ball having multi-layer cover with unique outer cover characteristics

PTO-2040 12/98

Certificate

OCT 28 2003

of Correction

ISSUING CLASSIFICATION

ORIGINAL CLASS	ORIGINAL SUBCLASS	CROSS REFERENCE(S) CLASS	CROSS REFERENCE(S) SUBCLASS (ONE SUBCLASS PER BLOCK)
473	374		

INTERNATIONAL CLASSIFICATION: A63B 37/12

☐ Continued on Issue Slip Inside File Jacket

12/04/02 Formal Drawings (2 shts) set 01 06/04/01

TERMINAL DISCLAIMER	DRAWINGS			CLAIMS ALLOWED	
	Sheets Drwg.	Figs. Drwg.	Print Fig.	Total Claims	Print Claim for O.G.
	1	2	1,2	11	1

☐ The term of this patent subsequent to _____ (date) has been disclaimed.

Steven Wong 9/18/02 (Assistant Examiner) (Date)

NOTICE OF ALLOWANCE MAILED: 9-27-02

☑ The term of this patent shall not extend beyond the expiration date of U.S Patent. No. 6,210,293

Steven Wong Primary Examiner

9/26/02 (Primary Examiner) (Date)

ISSUE FEE

Amount Due	Date Paid
1280	11-21-02

☐ The terminal ___ months of this patent have been disclaimed.

10/02 (Legal Instruments Examiner) (Date)

ISSUE BATCH NUMBER

WARNING:
The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code Title 35, Sections 122, 181 and 368. Possession outside the U.S. Patent & Trademark Office is restricted to authorized employees and contractors only.

Form PTO-436A (Rev. 6/99)

FILED WITH: ☐ DISK (CRF) ☐ FICHE ☐ CD-ROM
(Attached in pocket on right inside flap)

(FACE)

[redacted]

SEARCHED

Class	Sub.	Date	Exmr.
473	318 311 316 317 311 310 313 314	8-9-01	RG
updated search		1-18-02	RG
updated search		9-26-02	RG

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
473	314	~~9-18-02~~ 9-26-02	RG

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.

(RIGHT OUTSIDE)

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION	David		06-07-01
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW	[illegible]	JC-916	06-22-01
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✓ ..... Rejected		N ..... Non-elected	
= ..... Allowed		I ..... Interference	
— (Through numeral)... Canceled		A ..... Appeal	
÷ ..... Restricted		O ..... Objected	

Claim Final	Claim Original	Date 8/1/01	Date 8/?/02	Date 9/3/?	Date 9/24/?
[illegible]	1 (circled)	✓	✓	✓	=
[illegible]	2 (canceled)				
[illegible]	3 (canceled)				
[illegible]	4			✓	=
[illegible]	5			✓	=
[illegible]	6 (circled)			✓	=
[illegible]	7 (canceled)				
[illegible]	8			✓	=
[illegible]	9			✓	=
[illegible]	10			✓	=
[illegible]	11 (circled)			✓	=
[illegible]	12 (canceled)				
[illegible]	13 (canceled)				
[illegible]	14 (canceled)				
[illegible]	15			✓	=
[illegible]	16			✓	=
[illegible]	17	✓	✓	✓	=
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				
	36				
	37				
	38				
	39				
	40				
	41				
	42				
	43				
	44				
	45				
	46				
	47				
	48				
	49				
	50				

Claim Final	Claim Original	Date
	51	
	52	
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
	62	
	63	
	64	
	65	
	66	
	67	
	68	
	69	
	70	
	71	
	72	
	73	
	74	
	75	
	76	
	77	
	78	
	79	
	80	
	81	
	82	
	83	
	84	
	85	
	86	
	87	
	88	
	89	
	90	
	91	
	92	
	93	
	94	
	95	
	96	
	97	
	98	
	99	
	100	

Claim Final	Claim Original	Date
	101	
	102	
	103	
	104	
	105	
	106	
	107	
	108	
	109	
	110	
	111	
	112	
	113	
	114	
	115	
	116	
	117	
	118	
	119	
	120	
	121	
	122	
	123	
	124	
	125	
	126	
	127	
	128	
	129	
	130	
	131	
	132	
	133	
	134	
	135	
	136	
	137	
	138	
	139	
	140	
	141	
	142	
	143	
	144	
	145	
	146	
	147	
	148	
	149	
	150	

If more than 150 claims or 10 actions
staple additional sheet here

(LEFT INSIDE)

BEST AVAILABLE COPY

Form 3.54 Division-continuation
program application transmittal form
37 C.F.R. 1.53(b)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No. P-3724-F1-C1-C3
SLD 2 035-3-3-1-1-1(III)
IN RE APPLICATION OF: Sullivan
Prior application: 09/776,278

The Assistant Commissioner for Patents
Washington, D.C. 2023l
Box Patent Application

Sir:

This is a request for filing a continuation application under 37 C.F.R. 1.53(b), of pending prior application **U.S. Application Serial No. 09/776,278 filed February 2, 2001...(See Data Sheet for Cross References)**

Inventors: Michael J. Sullivan

For: **GOLF BALL HAVING MULTI-LAYER COVER WITH UNIQUE OUTER COVER CHARACTERISTICS**

1. **Papers Enclosed Which Are Required For Filing Date under 37 CFR 1.53(b) (Regular) or 37 CFR 1.153 (Design) Application**

   34 Pages of specification
   3 Pages of claims
   1 Page of Abstract
   1 Sheets of drawing

2. ____ A PRELIMINARY AMENDMENT is enclosed.

3. ____ Applicant claims small entity status.

4. ____ Request and Certification Under 35 U.S.C. 122(b)(2)(B)(i)

CERTIFICATE OF EXPRESS MAIL

I hereby certify that this **TRANSMITTAL LETTER and associated papers** are being deposited with the United States Postal Service by Express Mail Procedure in an envelope addressed to: Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231 on June 4, 2001. **Express Mailing Label No.** EL 852784875 US.

Mary Ann Temesvari
Mary Ann Temesvari

5. x The filing fee is calculated below.

CLAIMS AS FILED IN THE PRIOR APPLICATION LESS ANY CLAIMS CANCELED BY PRELIMINARY AMENDMENT			
Basic Filing Fee (Large Entity)			$ 710.00
		No. of Extra Claims Present	Additional Rate
Total Claims	17		$
Indep. Claims	3		$

Total fee $ 710.00

6. xxx A check in the amount of $710.00 is enclosed.

7. xxx The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Account No. 06-0308.

8. XXX The prior application is assigned of record to Spalding Sports Worldwide, Inc., as recorded in the U.S. Patent and Trademark Office.

9. xxx An Application Data Sheet is enclosed.

10. xxx The declaration/power of attorney in the prior application is to Richard M. Klein, Reg. No. 33,000. Copies of the declaration/power of attorney in the prior application are enclosed. Please address all future communications to:

Michelle Bugbee
Patent Counsel
Spalding Sports Worldwide, Inc.
425 Meadow Street
PO Box 901
Chicopee, MA 01021-0901

Customer No. 24492

11. Please direct all phone calls to Richard M. Klein or Mark E. Bandy at telephone No. (216)861-5582.

6/4/2001
Date

Richard M. Klein
Reg. No. 33,000
Mark E. Bandy
Reg. No. 35,788
FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP
1100 Superior Avenue, 7th Floor
Cleveland, Ohio 44114
(216) 861-5582

C:\DATA\MEB\S2035331.TR3

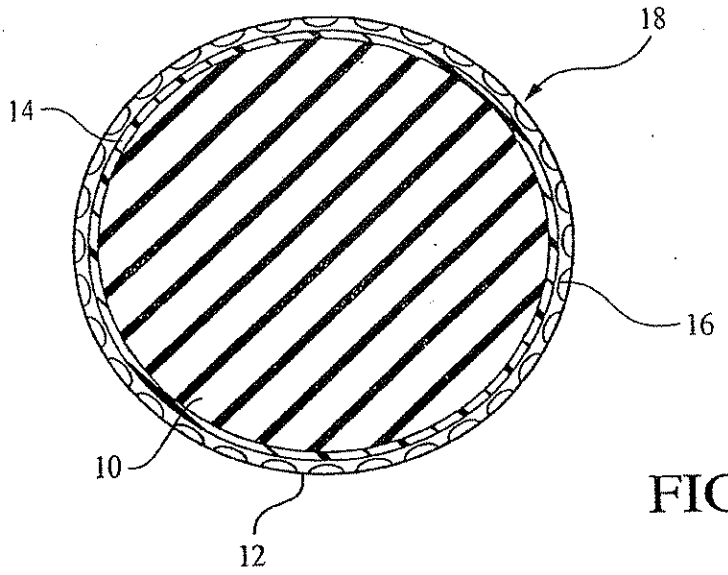


FIG. 1

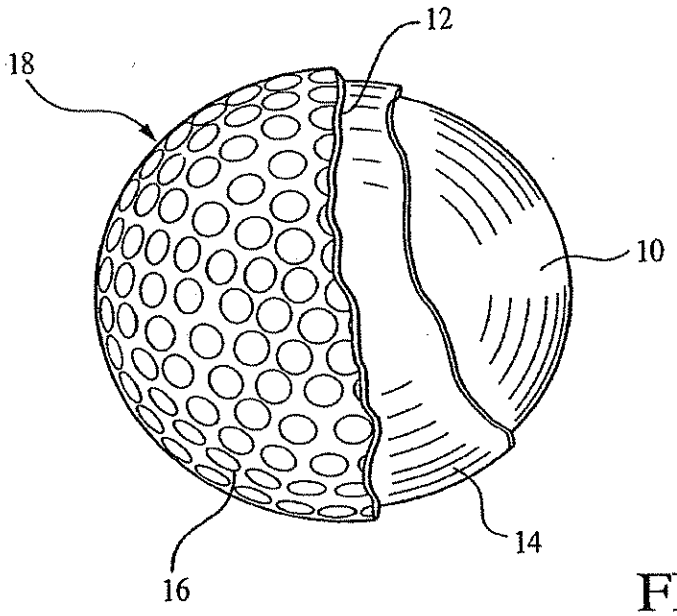


FIG. 2

GOLF BALL HAVING MULTI-LAYER COVER WITH UNIQUE OUTER COVER CHARACTERISTICS

Cross References to Related Applications

The present application is a continuation of U.S. Application Serial No. 09/776,278 filed February 2, 2001 which is a continuation of U.S. Application Serial No. 09/470,196 filed on December 21, 1999, which is a continuation of U.S. application Serial No. 08/870,585 filed June 6, 1997, which is a continuation of U.S. Application Serial No. 08/556,237 filed November 9, 1995 now abandoned, which is a continuation-in-part of U.S. Application Serial No. 08/070,510 filed on June 1, 1993, now abandoned.

Field of the Invention

The present invention relates to golf balls and, more particularly, to improved standard and oversized golf balls comprising multi-layer covers which have a comparatively hard inner layer and a relatively soft outer layer such as that produced by the use of a polyurethane based outer layer. The improved multi-layer golf balls provide for enhanced distance and durability properties over single layer cover golf balls while at the same time offering enhanced "feel" and spin characteristics generally associated with soft balata and balata-like covers of the prior art.

Background of the Invention

Traditional golf ball covers have been comprised of balata or blends of balata with elastomeric or plastic materials. The traditional balata covers are relatively soft and flexible. Upon impact, the soft balata covers compress against the surface of the club producing high spin. Consequently, the soft and flexible balata covers provide an experienced golfer with the ability to apply a spin to control the ball in flight in order to produce a draw or a fade, or a backspin which causes the ball to "bite" or stop abruptly on contact with the green. Moreover, the soft balata covers produce a soft "feel" to the low handicap player. Such

playability properties (workability, feel, etc.) are particularly important in short iron play with low swing speeds and are exploited significantly by relatively skilled players.

Despite all the benefits of balata, balata covered golf balls are easily cut and/or damaged if mis-hit. Golf balls produced with balata or balata-containing cover compositions therefore have a relatively short lifespan.

As a result of this negative property, balata and its synthetic substitutes, transpolyisoprene and transpolybutadiene, have been essentially replaced as the cover materials of choice by new cover materials comprising ionomeric resins.

~~Ionomeric resins are polymers containing interchain ionic bonding.~~ As a result of their toughness, durability and flight characteristics, various ionomeric resins sold by E. I. DuPont de Nemours & Company under the trademark Surlyn® and more recently, by the Exxon Corporation (see U. S. Patent No. 4,911,451) under the trademarks Escor® and Iotek®, have become the materials of choice for the construction of golf ball covers over the traditional "balata" (transpolyisoprene, natural or synthetic) rubbers. As stated, the softer balata covers, although exhibiting enhanced playability properties, lack the durability (cut and abrasion resistance, fatigue endurance, etc.) properties required ~~for repetitive play.~~

Ionomeric resins are generally ionic copolymers of an olefin, such as ethylene, and a metal salt of an unsaturated carboxylic acid, such as acrylic acid, methacrylic acid, or maleic acid. Metal ions, such as sodium or zinc, are used to neutralize some portion of the acidic group in the copolymer resulting in a thermoplastic elastomer exhibiting enhanced properties, i.e. durability, etc., for golf ball cover construction over balata. However, some of the advantages gained in increased durability have been offset to some degree by the decreases produced in playability. This is because although the ionomeric resins are very durable, they tend to be very hard when utilized for golf ball cover construction, and thus lack the degree of softness required to impart the spin necessary to control the ball in flight. Since the ionomeric resins are harder than balata, the ionomeric resin covers do not compress as much against the face of the club upon

impact, thereby producing less spin. In addition, the harder and more durable ionomeric resins lack the "feel" characteristic associated with the softer balata related covers.

As a result, there are currently more than fifty (50) commercial grades of ionomers available both from DuPont and Exxon, with a wide range of properties which vary according to the type and amount of metal cations, molecular weight, composition of the base resin (i.e., relative content of ethylene and methacrylic and/or acrylic acid groups) and additive ingredients such as reinforcement agents, etc. However, a great deal of research continues in order to develop a golf ball cover composition exhibiting not only the improved impact resistance and carrying distance properties produced by the "hard" ionomeric resins, but also the playability (i.e., "spin", "feel", etc.) characteristics previously associated with the "soft" balata covers, properties which are still desired by the more skilled golfer.

Consequently, a number of two-piece (a solid resilient center or core with a molded cover) and three-piece (a liquid or solid center, elastomeric winding about the center, and a molded cover) golf balls have been produced by the present inventor and others to address these needs. The different types of materials utilized to formulate the cores, covers, etc. of these balls dramatically alter the balls' overall characteristics.

In addition, multi-layered covers containing one or more ionomer resins have also been formulated in an attempt to produce a golf ball having the overall distance, playability and durability characteristics desired. For example, this was addressed by Spalding Sports Worldwide, Inc., the assignee of the present invention, in U. S. Patent No. 4,431,193 where a multi-layered, regular sized, golf ball is disclosed.

In the '193 patent, a multi-layer golf ball is produced by initially molding a first cover layer on a spherical core and then adding a second layer. The first layer is comprised of a hard, high flexural modulus resinous material such as type 1605 Surlyn® (now designated Surlyn® 8940). Type 1605 Surlyn® (Surlyn® 8940) is a sodium ion based low acid (less than or equal to 15 weight percent methacrylic acid) ionomer resin having a flexural modulus of about 51,000 psi. An

outer layer of a comparatively soft, low flexural modulus resinous material such as type 1855 Surlyn® (now designated Surlyn® 9020) is molded over the inner cover layer. Type 1855 Surlyn® (Surlyn® 9020) is a zinc ion based low acid (10 weight percent methacrylic acid) ionomer resin having a flexural modulus of about 14,000 psi.

The '193 patent teaches that the hard, high flexural modulus resin which comprises the first layer provides for a gain in coefficient of restitution over the coefficient of restitution of the core. The increase in the coefficient of restitution provides a ball which serves to attain or approach the maximum initial velocity limit of 255 feet per second as provided by the United States Golf Association (U.S.G.A.) rules. The relatively soft, low flexural modulus outer layer provides essentially no gain in the coefficient of restitution but provides for the advantageous "feel" and playing characteristics of a balata covered golf ball.

Unfortunately, however, while a ball of the '193 patent does exhibit enhanced playability characteristics with improved distance (i.e. enhanced C.O.R. values) over a number of other then known multi-layered balls, the ball suffers from poor cut resistance and relatively short distance (i.e. lower C.O.R. values) when compared to two-piece, single cover layer balls commercially available today. These undesirable properties make the ball produced in accordance with the '193 patent unacceptable by today's standards.

The present invention is directed to new multi-layer golf ball compositions which provide for enhanced coefficient of restitution (i.e, enhanced resilience or carrying distance) and/or durability properties when compared to the multi-layer balls found in the prior art, as well as improved outer cover layer softness and durability. As such, the playability characteristics (i.e., "feel", "click", "spin", etc.) are not diminished.

These and other objects and features of the invention will be apparent from the following summary and description of the invention, the drawings and from the claims.

Summary of the Invention

The present invention is directed to improved multi-layer golf ball cover compositions and the resulting multi-layer golf balls produced using the

5

improved compositions. The present invention provides, in the first aspect, a golf ball comprising a core, an inner cover layer having particular characteristics, and an outer cover layer, also with certain features. The inner cover layer has a Shore D hardness of at least 60 and comprises a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid. The outer cover layer has a Shore D hardness of from about 55 to about 59, a thickness of from about 0.01 to about 0.07 inches, and comprises a polyurethane material.

In another aspect, the present invention provides a golf ball comprising a core, and an inner cover layer and an outer cover layer. The inner cover layer has a Shore D hardness of at least 60, and comprises a blend of two or more low acid ionomers, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid. The outer cover layer has a Shore D hardness of from about 60 to about 68, a thickness of from about 0.01 to about 0.07 inches, and comprises a polyurethane material.

In yet another aspect, the present invention provides a golf ball comprising a core, an inner cover layer disposed on the core, and an outer cover layer disposed about the inner cover layer. The inner cover layer has a Shore D hardness of about 60 or more, and comprises an ionomeric resin including no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid having a modulus of from about 15,000 to about 70,000 psi. The outer cover layer has a Shore D hardness of from about 55 to about 68, a thickness from about 0.01 to ~~about 0.07 inches, and comprises a polyurethane material.~~

It has been found that multi-layer golf balls having inner and outer cover layers exhibit higher C.O.R. values and have greater travel distance in comparison with balls made from a single cover layer. In addition, it has been found that use of an inner cover layer constructed of a blend of low acid (i.e., 16 weight percent acid or less) ionomer resins produces softer compression and higher spin rates than inner cover layers constructed of high acid ionomer resins. This is compounded by the fact that the softer polyurethane outer layer adds to the desirable "feel" and high spin rate while maintaining respectable resiliency. The soft outer layer allows the cover to deform more during impact and increases the

area of contact between the club face and the cover, thereby imparting more spin on the ball. As a result, the soft polyurethane cover provides the ball with a balata-like feel and playability characteristics with improved distance and durability.

Consequently, the overall combination of the inner and outer cover layers made from blends of low acid ionomer resins and polyurethane results in a standard size or oversized golf ball having enhanced resilience (improved travel distance) and durability (i.e. cut resistance, etc.) characteristics while maintaining and in many instances, improving the balls playability properties.

~~The combination of a low acid ionomer blend inner cover layer with~~ a soft, relatively low modulus ionomer, polyurethane based elastomer outer cover layer provides for overall coefficient of restitution (i.e., excellent resilience) while at the same time demonstrating improved compression and spin. The outer cover layer generally contributes to a more desirable feel and high spin, particularly at ~~lower swing speeds with highly lofted clubs such as half wedge shots~~.

Two principal properties involved in golf ball performance are resilience and hardness. Resilience is determined by the coefficient of restitution (C.O.R.), the constant "e" which is the ratio of the relative velocity of two elastic spheres after direct impact to that before impact. As a result, the coefficient of restitution ("e") can vary from 0 to 1, with 1 being equivalent to an elastic collision and 0 being equivalent to an inelastic collision.

Resilience (C.O.R.), along with additional factors such as club head speed, angle of trajectory and ball configuration (i.e., dimple pattern) generally determine the distance a ball will travel when hit. Since club head speed and the angle of trajectory are factors not easily controllable by a manufacturer, factors of concern among manufacturers are the coefficient of restitution (C.O.R.) and the surface configuration of the ball.

The coefficient of restitution (C.O.R.) in solid core balls is a function of the composition of the molded core and of the cover. In balls containing a wound core (i.e., balls comprising a liquid or solid center, elastic windings, and a cover), the coefficient of restitution is a function of not only the composition of the center and cover, but also the composition and tension of the elastomeric windings. Although both the core and the cover contribute to the coefficient of

restitution, the present invention is directed to the enhanced coefficient of restitution (and thus travel distance) which is affected by the cover composition.

In this regard, the coefficient of restitution of a golf ball is generally measured by propelling a ball at a given speed against a hard surface and measuring the ball's incoming and outgoing velocity electronically. As mentioned above, the coefficient of restitution is the ratio of the outgoing velocity to the incoming velocity. The coefficient of restitution must be carefully controlled in all commercial golf balls in order for the ball to be within the specifications regulated by the United States Golf Association (U.S.G.A.). Along this line, the U.S.G.A. standards indicate that a "regulation" ball cannot have an initial velocity (i.e., the speed off the club) exceeding 255 feet per second. Since the coefficient of restitution of a ball is related to the ball's initial velocity, it is highly desirable to produce a ball having sufficiently high coefficient of restitution to closely approach the U.S.G.A. limit on initial velocity, while having an ample degree of softness (i.e., hardness) to produce enhanced playability (i.e., spin, etc.).

The hardness of the ball is the second principal property involved in the performance of a golf ball. The hardness of the ball can affect the playability of the ball on striking and the sound or "click" produced. Hardness is determined by the deformation (i.e., compression) of the ball under various load conditions applied across the ball's diameter (i.e., the lower the compression value, the harder the material). As indicated in U.S. Patent No. 4,674,751, softer covers permit the accomplished golfer to impart proper spin. This is because the softer covers deform on impact significantly more than balls having "harder" ionomeric resin covers. As a result, the better player is allowed to impart fade, draw or backspin to the ball thereby enhancing playability. Such properties may be determined by various spin rate tests such as the "nine iron" spin rate test described below in the Examples.

Accordingly, the present invention is directed to an improved multi-layer cover which produces, upon molding each layer around a core (preferably a solid core) to formulate a multi-layer cover, a golf ball exhibiting enhanced distance (i.e., resilience) without adversely affecting, and in many instances,

improving the ball's playability (hardness/softness) and/or durability (i.e., cut resistance, fatigue resistance, etc.) characteristics.

These and other objects and features of the invention will be apparent from the following detailed description.

Brief Description of the Drawings

FIG. 1 is a cross-sectional view of a golf ball embodying the invention illustrating a core 10 and a cover 12 consisting of an inner layer 14 and an outer layer 16 having dimples 18; and

FIG. 2 is a diametrical cross-sectional view of a golf ball of the invention having a core 10 and a cover 12 made of an inner layer 14 and an outer layer 16 having dimple 18.

~~Detailed Description of the Preferred Embodiments~~

The present invention relates to improved multi-layer golf balls, particularly a golf ball comprising a multi-layered cover 12 over a solid core 10, and method for making same.

The multi-layered cover 12 comprises two layers: a first or inner layer or ply 14 and a second or outer layer or ply 16. The inner layer 14 is comprised of a low acid (i.e. 16 weight percent acid or less) ionomer blend. Preferably, the inner layer is comprised of a blend of two or more low acid (i.e. 16 weight percent acid or less) ionomer resins neutralized to various extents by different metal cations. The inner cover layer may or may not include a metal stearate (e.g., zinc stearate) or other metal fatty acid salt. The purpose of the metal stearate or other metal fatty acid salt is to lower the cost of production without affecting the overall performance of the finished golf ball.

~~The~~ low acid ionomers which may ~~be suitable for use in formulating~~ the inner layer compositions of the subject invention are ionic copolymers which are the metal, i.e., sodium, zinc, magnesium, etc., salts of the reaction product of an olefin having from about 2 to 8 carbon atoms and an unsaturated monocarboxylic acid having from about 3 to 8 carbon atoms. Preferably, the ionomeric resins are copolymers of ethylene and either acrylic or methacrylic acid.

In some circumstances, an additional comonomer such as an acrylate ester (i.e., iso- or n-butylacrylate, etc.) can also be included to produce a softer terpolymer. The carboxylic acid groups of the copolymer are partially neutralized (i.e., approximately 10-75%, preferably 30-70%) by the metal ions. Each of the low acid ionomer resins which may be included in the cover layer compositions of the invention contains 16% by weight or less of a carboxylic acid.

The inner layer compositions include the low acid ionomers such as those developed and sold by E. I. DuPont de Nemours & Company under the trademark Surlyn® and by Exxon Corporation under the trademarks Escor® or Iotek®, or blends thereof.

The low acid ionomeric resins available from Exxon under the designation Escor® and or Iotek®, are somewhat similar to the low acid ionomeric resins available under the Surlyn® trademark. However, since the Escor®/Iotek® ionomeric resins are sodium or zinc salts of poly(ethylene-acrylic acid) and the Surlyn® resins are zinc, sodium, magnesium, etc. salts of poly(ethylene-methacrylic acid), distinct differences in properties exist.

When utilized in the construction of the inner layer of a multi-layered golf ball, it has been found that the low acid ionomer blends extend the range of compression and spin rates beyond that previously obtainable. More preferably, it has been found that when two or more low acid ionomers, particularly blends of sodium and zinc high acid ionomers, are processed to produce the covers of multi-layered golf balls, (i.e., the inner cover layer herein) the resulting golf balls will travel further and at an enhanced spin rate than previously known multi-layered golf balls. Such an improvement is particularly noticeable in enlarged or oversized golf balls.

For example, the normal size, multi-layer golf ball taught in 4,650,193 does not incorporate blends of low acid ionomeric resins of the present invention in the inner cover layer. In addition, the multi-layered ball disclosed in the '193 patent suffers substantially in durability in comparison with the present invention.

Furthermore, as shown in the Examples, use of an inner layer formulated from blends of lower acid ionomers produces multi-layer golf balls

having enhanced compression and spin rates. These are the properties desired by the more skilled golfer.

With respect to the outer layer 16 of the multi-layered cover of the present invention, the outer cover layer is comparatively softer than the low acid ionomer blend based inner layer. The softness provides for the enhanced feel and playability characteristics typically associated with balata or balata-blend balls. The outer layer or ply, is comprised of a relatively soft, low modulus (about 1,000 psi to about 10,000 psi) and low acid (less than 16 weight percent acid) ionomer, ionomer blend or a non-ionomeric elastomer such as, but not limited to, a polyurethane, a polyester elastomer such as that marketed by DuPont under the trademark Hytrel®, a polyurethane sold by BASF under the designation Baytec® or a polyether amide such as that marketed by Elf Atochem S.A. under the trademark Pebax®. The outer layer is fairly thin (i.e. from about 0.010 to about 0.070 in thickness, more desirably 0.03 to 0.06 inches in thickness for a 1.680 inch ball and 0.04 to 0.07 inches in thickness for a 1.72 inch ball), but thick enough to achieve desired playability characteristics while minimizing expense.

Sub A9

~~Preferably, the outer layer includes a blend of hard and soft (low~~ acid) ionomer resins such as those described in U. S. Patent Nos. 4,884,814 and 5,120,791, both incorporated herein by reference. Specifically, a desirable material for use in molding the cover layer comprises a blend of a high modulus (hard), low acid, ionomer with a low modulus (soft) low acid, ionomer to form a base ionomer mixture. A high modulus ionomer herein is one which measures from about 15,000 to about 70,000 psi as measured in accordance with ASTM method D-790. The hardness may be defined as at least 50 on the Shore D scale ~~as measured in accordance with ASTM method D-2240~~.

A low modulus ionomer suitable for use in the outer layer blend has a flexural modulus measuring from about 1,000 to about 10,000 psi, with a hardness of about 20 to about 40 on the Shore D scale.

Sub A10

~~The hard ionomer resins utilized to produce the cover layer~~ composition hard/soft blends include ionic copolymers which are the sodium, zinc, magnesium or lithium salts of the reaction product of an olefin having from 2 to 8 carbon atoms and an unsaturated monocarboxylic acid having from 3 to 8 carbon

~~atoms. The carboxylic acid groups of the copolymer may be totally or partially (i.e. approximately 15-75 percent) neutralized.~~

The hard ionomeric resins are likely copolymers of ethylene and either acrylic and/or methacrylic acid, with copolymers of ethylene and acrylic acid being the most preferred. Two or more types of hard ionomeric resins may be blended into the outer cover layer compositions in order to produce the desired properties of the resulting golf balls.

As discussed earlier herein, the ~~hard ionomeric resins introduced~~ under the designation Escor® and sold under the designation Iotek® are somewhat similar to the hard ionomeric resins sold under the Surlyn® trademark. However, since the Iotek® ionomeric resins are sodium or zinc salts of poly(ethylene-acrylic acid) and the Surlyn® resins are zinc or sodium salts of poly(ethylene-methacrylic acid) some distinct differences in properties exist. As more specifically indicated in the data set forth below, the hard Iotek® resins (i.e., the acrylic acid based hard ionomer resins) are the more preferred hard resins for use in formulating the cover layer blends for use in the present invention. In addition, various blends of Iotek® and Surlyn® hard ionomeric resins, as well as other available ionomeric resins, may be utilized in the present invention in a similar manner.

Examples of commercially available hard ionomeric resins which may be used in the present invention in formulating the inner and outer cover blends include the hard sodium ionic copolymer sold under the trademark Surlyn® 8940 and the hard zinc ionic copolymer sold under the trademark Surlyn® 9910. Surlyn® 8940 is a copolymer of ethylene with methacrylic acid and about 15 weight percent acid which is about 29 percent neutralized with sodium ions. This resin has an average melt flow index of about 2.8 gm/10 min. Surlyn® 9910 is a copolymer of ethylene and methacrylic acid with about 15 weight percent acid which is about 58 percent neutralized with zinc ions. The average melt flow index of Surlyn® 9910 is about 0.7 gm/10 min. The typical properties of Surlyn® 9910 and 8940 are set forth below in Table 1.

TABLE 1

Typical Properties of Commercially Available Hard Surlyn® Resins Suitable for Use in the Cover Layers of the Present Invention

	ASTM D	8940	9910	8920	8528	9970	9730
Cation Type		Sodium	Zinc	Sodium	Sodium	Zinc	Zinc
Melt flow index, gms/10 min.	D-1238	2.8	0.7	0.9	1.3	14.0	1.6
Specific Grevity, g/cm^3	D-792	0.95	0.97	0.95	0.94	0.95	0.95
Hardness, Shore D	D-2240	66	64	66	60	62	63
Tensile Strength, (kpsi), MPa	D-638	(4.8) 33.1	(3.6) 24.8	(5.4) 37.2	(4.2) 29.0	(3.2) 22.0	(4.1) 28.0
Elongation, %	D-638	470	290	350	450	460	460
Flexural Modulus, (kpsi) MPa	D-790	(51) 350	(48) 330	(55) 380	(32) 220	(28) 190	(30) 210
Tensile Impact (23°C) KJ/m^2 (ft.-lbs./in^2)	D-1822S	1020 (485)	1020 (485)	865 (410)	1160 (550)	760 (360)	1240 (590)
Vicat Softening Temperature, °C	D-1525	63	62	58	73	61	73

Examples of the more pertinent acrylic acid based hard ionomer resins suitable for use in the present inner and outer cover composition sold under the Iotek® trademark by the Exxon Corporation include Iotek® 4000, Iotek® 4010, Iotek® 8000, Iotek® 8020 and Iotek® 8030. The typical properties of these and other Iotek® hard ionomers suited for use in formulating the inner and outer layer cover composition are set forth below in Table 2:

Sub A(3)

TABLE 2

Typical Properties of Iotek® Ionomers

	Resin Properties	ASTM Method	Units	4000	4010	8000	8020	8030
	Cation type			zinc	zinc	sodium	sodium	sodium
	Melt index	D-1238	g/10 min.	2.5	1.5	0.8	1.6	2.8
	Density	D-1505	kg/m^3	963	963	954	960	960
	Melting Point	D-3417	°C	90	90	90	87.5	87.5
	Crystallization Point	D-3417	°C	62	64	56	53	55
	Vicat Softening Point	D-1525	°C	62	63	61	64	67
	% Weight Acrylic Acid			16		11		
	% of Acid Groups cation neutralized			30		40		
	Plaque Properties (3 mm thick, compression molded)	ASTM Method	Units	4000	4010	8000	8020	8030
	Tensile at break	D-638	MPa	24	26	36	31.5	28
	Yield point	D-638	MPa	none	none	21	21	23
	Elongation at break	D-638	%	395	420	350	410	395
	1% Secant modulus	D-638	MPa	160	160	300	350	390
	Shore Hardness D	D-2240	--	55	55	61	58	59
	Film Properties (50 micron film 2.2:1 Blow-up ratio)			4000	4010	8000	8020	8030
	Tensile at Break MD	D-882	MPa	41	39	42	52	47.4
	TD	D-882	MPa	37	38	38	38	40.5
	Yield point MD	D-882	MPa	15	17	17	23	21.6
	TD	D-882	MPa	14	15	15	21	20.7
	Elongation at Break MD	D-882	%	310	270	260	295	305
	TD	D-882	%	360	340	280	340	345
	1% Secant modulus MD	D-882	MPa	210	215	390	380	380
	TD	D-882	MPa	200	225	380	350	345
	Dart Drop Impact	D-1709	g/micron	12.4	12.5	20.3		

Resin Properties Cation type	ASTM Method	Units	7010 zinc	7020 zinc	7030 zinc
Melt Index	D-1238	g/10 min.	0.8	1.5	2.5
Density	D-1505	kg/m^3	960	960	960
Melting Point	D-3417	°C	90	90	90
Vicat Softening Point	D-1525	°C	60	63	62.5

Plaque Properties (3 mm thick, compression molded)	ASTM Method	Units	7010	7020	7030
Tensile at break	D-638	MPa	38	38	38
Yield Point	D-638	MPa	none	none	none
Elongation at break	D-638	%	500	420	395
Shore Hardness D	D-2240	--	57	55	55

Comparatively, soft ionomers may be used in formulating the hard/soft blends of the inner and outer cover compositions. These ionomers include acrylic acid based soft ionomers. They are generally characterized as comprising sodium or zinc salts of a terpolymer of an olefin having from about 2 to 8 carbon atoms, acrylic acid, and an unsaturated monomer of the acrylate ester class having from 1 to 21 carbon atoms. The soft ionomer is preferably a zinc based ionomer made from an acrylic acid base polymer in an unsaturated monomer of the acrylate ester class. The soft (low modulus) ionomers have a hardness from about 20 to about 40 as measured on the Shore D scale and a flexural modulus from about 1,000 to about 10,000, as measured in accordance with ASTM method D-790.

Certain ethylene-acrylic acid based soft ionomer resins developed by the Exxon Corporation under the designation Iotek® 7520 (referred to experimentally by differences in neutralization and melt indexes as LDX 195, LDX 196, LDX 218 and LDX 219) may be combined with known hard ionomers such as those indicated above to produce the inner and outer cover layers. The combination produces higher C.O.R.s at equal or softer hardness, higher melt flow (which corresponds to improved, more efficient molding, i.e., fewer rejects) as well as significant cost savings versus the outer layer of multi-layer balls produced by

~~other known hard-soft ionomer blends as a result of the lower overall raw materials costs and improved yields.~~

While the exact chemical composition of the resins to be sold by Exxon under the designation Iotek® 7520 is considered by Exxon to be confidential and proprietary information, Exxon's experimental product data sheet lists the following physical properties of the ethylene acrylic acid zinc ionomer developed by Exxon:

TABLE 3

Physical Properties of Iotek® 7520

Property	ASTM Method	Units	Typical Value
Melt Index	D-1238	g/10 min.	2
Density	D-1505	kg/m^3	0.962
Cation			Zinc
Melting Point	D-3417	°C	66
Crystallization Point	D-3417	°C	49
Vicat Softening Point	D-1525	°C	42
Plaque Properties (2 mm thick Compression Molded Plaques)			
Tensile at Break	D-638	MPa	10
Yield Point	D-638	MPa	None
Elongation at Break	D-638	%	760
1% Secant Modulus	D-638	MPa	22
Shore D Hardness	D-2240		32
Flexural Modulus	D-790	MPa	26
Zwick Rebound	ISO 4862	%	52
De Mattia Flex Resistance	D-430	Cycles	>5000

~~In addition, test data collected by the Assignee indicates that Iotek®~~ 7520 resins have Shore D hardnesses of about 32 to 36 (per ASTM D-2240), melt flow indexes of 3±0.5 g/10 min (at 190°C. per ASTM D-1288), and a flexural modulus of about 2500-3500 psi (per ASTM D-790). Furthermore, testing by an independent testing laboratory by pyrolysis mass spectrometry indicates that

Iotek® 7520 resins are generally zinc salts of a terpolymer of ethylene, acrylic acid, and methyl acrylate.

Furthermore, it has been found that a grade of an acrylic acid based soft ionomer available from the Exxon Corporation under the designation Iotek® 7510, is also effective, when combined with the hard ionomers indicated above in producing golf ball covers exhibiting higher C.O.R. values at equal or softer hardness than those produced by known hard-soft ionomer blends. In this regard, Iotek® 7510 has the advantages (i.e. improved flow, higher C.O.R. values at equal hardness, increased clarity, etc.) produced by the Iotek® 7520 resin when compared to the methacrylic acid base soft ionomers known in the art (such as the Surlyn® 8625 and the Surlyn® 8629 combinations disclosed in U.S. Patent No. 4,884,814).

In addition, Iotek® 7510, when compared to Iotek® 7520, produces slightly higher C.O.R. valves at equal softness/hardness due to the Iotek® 7510's higher hardness and neutralization. Similarly, Iotek® 7510 produces better release properties (from the mold cavities) due to its slightly higher stiffness and lower flow rate than Iotek® 7520. This is important in production where the soft covered balls tend to have lower yields caused by sticking in the molds and subsequent punched pin marks from the knockouts.

According to Exxon, Iotek® 7510 is of similar chemical composition as Iotek® 7520 (i.e. a zinc salt of a terpolymer of ethylene, acrylic acid, and methyl acrylate) but is more highly neutralized. Based upon FTIR analysis, Iotek® 7520 is estimated to be about 30-40 wt.-% neutralized and Iotek® 7510 is estimated to be about 40-60 wt.-% neutralized. The typical properties of Iotek® 7510 in comparison of those of Iotek® 7520 are set forth below:

TABLE 4

Physical Properties of Iotek® 7510
in Comparison to Iotek® 7520

	IOTEK® 7520	IOTEK® 7510
MI, g/10 min	2.0	0.8
Density, g/cc	0.96	0.97
Melting Point, °F	151	149
Vicat Softening Point, °F	108	109
Flex Modulus, psi	3800	5300
Tensile Strength, psi	1450	1750
Elongation, %	760	690
Hardness, Shore D	32	35

It has been determined that when high acid/low acid ionomer blends are used for the cover layers, good results are achieved when the relative combination is in a range of about 90 to about 10 percent hard ionomer and about 10 to about 90 percent soft ionomer. The results are improved by adjusting the range to about 75 to 25 percent hard ionomer and 25 to 75 percent soft ionomer. Even better results are noted at relative ranges of about 60 to 90 percent hard ionomer resin and about 40 to 60 percent soft ionomer resin.

Specific formulations which may be used in the cover composition are included in the examples set forth in U. S. Patent No. 5,120,791 and 4,884,814. The present invention is in no way limited to those examples.

Moreover, in alternative embodiments, the outer cover layer formulation may also comprise a soft, low modulus non-ionomeric thermoplastic elastomer including a polyester polyurethane such as B.F.Goodrich Company's Estane® polyester polyurethane X-4517. According to B.F.Goodrich, Estane® X-4517 has the following properties:

Properties of Estane® X-4517

Tensile	1430
100%	815
200%	1024
300%	1193
Elongation	641
Youngs Modulus	1826

Hardness A/D	88/39
Dayshore Rebound	59
Solubility in Water	Insoluble
Melt processing temperature	>350°F (>177°C)
Specific Gravity (H_2O=1)	1.1-1.3

Other soft, relatively low modulus non-ionomeric thermoplastic elastomers may also be utilized to produce the outer cover layer as long as the non-ionomeric thermoplastic elastomers produce the playability and durability characteristics desired without adversely effecting the enhanced characteristics produced by the low acid ionomer resin composition. These include, but are not limited to thermoplastic polyurethanes such as: Texin® thermoplastic polyurethanes from Mobay Chemical Co. and the Pellethane® thermoplastic polyurethanes from Dow Chemical Co.; Ionomer/rubber blends such as those in Spalding U.S. Patents 4,986,545; 5,098,105 and 5,187,013; and, Hytrel® polyester elastomers from DuPont and Pebax® polyetheramides from Elf Atochem S.A.

Similarly, a castable, thermosetting polyurethane produced by BASF under the trade designation Baytec® has also shown enhanced cover formulation properties. According to BASF, Baytec® (such as Baytec® RE 832), relates to a group of reactive elastomers having outstanding wear resistance, high mechanical strength, high elasticity and good resistance to weathering, moisture and chemicals. The Baytec® RE-832 system gives the following typical physical properties:

Property	ASTM Test Method	Unit	Value
Tear Strength Die C	D624	psi	180
Stress at			
100% Modulus	D412	psi	320
200% Modulus			460
300% Modulus			600
Ultimate Strength	D412	psi	900
Elongation at Break	D412	%	490
Taber Abrasion	D460, H-18	mg/1000 cycles	350

Component[1] Properties	Part A (Isocyanate)	Part B (Resin)
Viscosity @ 25°C, mPa·s	2500	2100
Density @ 25°C, g/cm	1.08	1.09
NCO, %	9.80	----------
Hydroxyl Number, Mg KOH/g	----------	88

[1]Component A is a modified diphenylmethane diisocyanate (MDI) prepolymer and component B is a polyether polyol blend.

In preparing golf balls in accordance with the present invention, a hard inner cover layer is molded (by injection molding or by compression molding) about a core (preferably a solid core). A comparatively softer outer layer is molded over the inner layer.

The conventional solid core is about 1.545 inches in diameter, although it can range from about 1.495 to about 1.575 inches. Conventional solid cores are typically compression molded from a slug of uncured or lightly cured elastomer composition comprising a high cis content polybutadiene and a metal salt of an α, β, ethylenically unsaturated carboxylic acid such as zinc mono or diacrylate or methacrylate. To achieve higher coefficients of restitution in the core, the manufacturer may include fillers such as small amounts of a metal oxide such as zinc oxide. In addition, larger amounts of metal oxide than those that are needed to achieve the desired coefficient are often included in conventional cores in order to increase the core weight so that the finished ball more closely approaches the U.S.G.A. upper weight limit of 1.620 ounces. Other materials may be used in the core composition including compatible rubbers or ionomers, and low molecular weight fatty acids such as stearic acid. Free radical initiators such as peroxides are admixed with the core composition so that on the application of heat and pressure, a complex curing cross-linking reaction takes place.

The inner cover layer which is molded over the core is about 0.100 inches to about 0.010 inches in thickness, preferably about 0.0375 inches thick. The outer cover layer is about 0.010 inches to about 0.050 inches in thickness, preferably 0.0300 inches thick. Together, the core, the inner cover layer and the outer cover layer combine to form a ball having a diameter of 1.680 inches or

more, the minimum diameter permitted by the rules of the United States Golf Association and weighing about 1.620 ounces.

Additional materials may be added to the cover compositions (both inner and outer cover layer) of the present invention including dyes (for example, Ultramarine Blue sold by Whitaker, Clark and Daniels of South Plainsfield, N.J.) (see U.S. Patent No. 4,679,795); pigments such as titanium dioxide, zinc oxide, barium sulfate and zinc sulfate; and UV absorbers; antioxidants; antistatic agents; and stabilizers. Further, the cover compositions of the present invention may also contain softening agents, such as plasticizers, processing aids, etc. and reinforcing material such as glass fibers and inorganic fillers, as long as the desired properties produced by the golf ball covers are not impaired.

The various cover composition layers of the present invention may be produced according to conventional melt blending procedures. In the case of the outer cover layer, when a blend of hard and soft, low acid ionomer resins are utilized, the hard ionomer resins are blended with the soft ionomeric resins and with a masterbatch containing the desired additives in a Banbury mixer, two-roll mill, or extruder prior to molding. The blended composition is then formed into slabs and maintained in such a state until molding is desired. Alternatively, a simple dry blend of the pelletized or granulated resins and color masterbatch may be prepared and fed directly into the injection molding machine where homogenization occurs in the mixing section of the barrel prior to injection into the mold. If necessary, further additives such as an inorganic filler, etc., may be added and uniformly mixed before initiation of the molding process. A similar process is utilized to formulate the high acid ionomer resin compositions used to produce the inner cover layer.

The golf balls of the present invention can be produced by molding processes currently well known in the golf ball art. Specifically, the golf balls can be produced by injection molding or compression molding the inner cover layer about wound or solid molded cores to produce an intermediate golf ball having a diameter of about 1.50 to 1.67 inches, preferably about 1.620 inches. The outer layer is subsequently molded over the inner layer to produce a golf ball having a diameter of 1.680 inches or more. Although either solid cores or wound cores can

be used in the present invention, as a result of their lower cost and superior performance, solid molded cores are preferred over wound cores.

In compression molding, the inner cover composition is formed via injection at about 380°F to about 450°F into smooth surfaced hemispherical shells which are then positioned around the core in a mold having the desired inner cover thickness and subjected to compression molding at 200° to 300°F for about 2 to 10 minutes, followed by cooling at 50°to 70°F for about 2 to 7 minutes to fuse the shells together to form a unitary intermediate ball. In addition, the intermediate balls may be produced by injection molding wherein the inner cover layer is injected directly around the core placed at the center of an intermediate ball mold for a period of time in a mold temperature of from 50°F to about 100°F. Subsequently, the outer cover layer is molded about the core and the inner layer by similar compression or injection molding techniques to form a dimpled golf ball of a diameter of 1.680 inches or more.

After molding, the golf balls produced may undergo various further processing steps such as buffing, painting and marking as disclosed in U.S. Patent No. 4,911,451.

~~The resulting golf ball produced from the low acid ionomer resin~~ inner layer and the relatively softer, low flexural modulus outer layer provide for an improved multi-layer golf ball which provides for desirable coefficient of restitution and durability properties while at the same time offering the feel and spin ~~characteristics associated with soft balata and balata-like covers of the prior art.~~

The present invention is further illustrated by the following examples in which the parts of the specific ingredients are by weight. It is to be understood that the present invention is not limited to the examples, and various changes and modifications may be made in the invention without departing from the spirit and scope thereof.

Example 1

Several intermediate balls (cores plus inner cover layers) were prepared in accordance with conventional molding procedures described above. The inner cover compositions were molded around 1.545 inch diameter cores

weighing 36.5 grams such that the inner cover had a wall thickness of about 0.0675 inches, with the overall ball measuring about 1.680 inches in diameter.

The cores utilized in the examples were comprised of the following ingredients: high cis-polybutadiene, zinc diacrylate, zinc oxide, zinc stearate, peroxide, calcium carbonate, etc. The molded cores exhibited Riehle compressions of about 60 and C.O.R. values of about .800. A representative formulation of the molded cores is set forth below:

MATERIAL	WEIGHT
BR-1220 (high cis-polybutadiene)	70.70
Taktene® 220 (high cis-polybutadiene)	29.30
React Rite™ ZDA (zinc diacrylate)	31.14
Zinc Oxide	6.23
Zinc Stearate	20.15
Limestone	17.58
Ground Flash (20-40 Mesh)	20.15
Blue Masterbatch	.012
Luperco® 231XL or Trigonox® 29/40	.89
Papi® 94	.50

[1] Blue Masterbatch consists of unknown compositions used only for internal identification purposes and has no effect on physical properties.

The inner cover compositions designated herein as compositions A-E utilized to formulate the intermediate balls are set forth in Table 7 below. The resulting molded intermediate balls were tested to determine the individual compression (Riehle), C.O.R., Shore C hardness, spin rate and cut resistance properties. These results are also set forth in Table 7 below.

The data of these examples are the average of twelve intermediate balls produced for each example. The properties were measured according to the following parameters:

Coefficient of restitution (C.O.R.) was measured by firing the resulting golf ball in an air cannon at a velocity of 125 feet per second against a steel plate. The rebound velocity was then measured. The rebound velocity was divided by the forward velocity to give a coefficient of restitution. Details for this

~~procedure are set forth in U.S. Patent 5,984,806, herein incorporated by reference.~~

Shore hardness was measured generally in accordance with ASTM test 2240.

Cut resistance was measured in accordance with the following procedure: A golf ball is fired at 135 feet per second against the leading edge of a pitching wedge wherein the leading edge radius is 1/32 inch, the loft angle is 51 degrees, the sole radius is 2.5 inches and the bounce angle is 7 degrees.

The cut resistance of the balls tested herein was evaluated on a scale of 1 to 5. The number 1 represents a cut that extends completely through the cover to the core. A 2 represents a cut that does not extend completely through he cover but that does break the surface. A 3 does not break the surface of the cover but does leave a permanent dent. A 4 leaves only a slight crease which is permanent but not as severe as 3. A 5 represents virtually no visible indentation or damage of any sort.

The spin rate of the golf ball was measured by striking the resulting golf balls with a pitching wedge or 9 iron wherein the club head speed is about 105 feet per second and the ball is launched at an angle of 26 to 34 degrees with an initial velocity of about 110 to 115 feet per second. The spin rate was measured by observing the rotation of the ball in flight using stop action Strobe photography.

Initial velocity is the velocity of a ball when struck at a hammer speed of 143.8 feet per second in accordance with a test as prescribed by the U.S.G.A.

As will be noted, compositions A, B and C include high acid ionomeric resins (16% or more acid), with composition B further including zinc stearate. Composition D represents the inner layer (i.e. Surlyn® 1605) used in U.S. Patent No. 4,431,193. Composition E provides a hard, low acid ionomeric resin blend.

Sub A9

~~The purpose behind producing and testing the balls of Table 11 was to provide a subsequent comparison in properties with the multi-layer golf balls of the present invention.~~

Table 5

Molded Intermediate Golf Balls

Ingredients of Inner Cover Compositions	A	B	C	D	E
Iotek® 959	50	50	--	--	--
Iotek® 960	50	50	--	--	--
Zinc® Stearate	--	50	--	--	--
Surlyn® 8162	--	--	75	--	--
Surlyn® 8422	--	--	25	--	--
Surlyn® 1605	--	--	--	100	--
Iotek® 7030	--	--	--	--	50
Iotek® 8000	--	--	--	--	50
Properties of Molded Intermediate Balls					
Compression	58	58	60	63	62
C.O.R.	.811	.810	.807	.793	.801
Shore C Hardness	98	98	97	96	96
Spin Rate (R.P.M.)	7,367	6,250	7,903	8,337	7,956
Cut Resistance	4-5	4-5	4-5	4-5	4-5

As shown in Table 5 above, the high acid ionomer resin inner cover layer (molded intermediate balls A-C) have lower spin rates and exhibit higher resiliency characteristics than the low acid ionomer resin based inner cover layers of balls D and E.

Multi-layer balls in accordance with the present invention were then prepared. Specifically, the inner cover compositions used to produce intermediate golf balls from Table 5 were molded over the solid cores to a thickness of about 0.0375 inches, thus forming the inner layer. The diameter of the solid core with the inner layer measured about 1.620 inches. Alternatively, the intermediate golf balls of Table 5 were ground down using a centerless grinding machine to a size of 1.620 inches in diameter to produce an inner cover layer of 0.0375 inches.

The size of 1.620 inches was determined after attempting to mold the outer cover layer to various sizes (1.600", 1.610", 1.620", 1.630" and 1.640") of intermediate (core plus inner layer) balls. It was determined that 1.620" was about the largest "intermediate" ball (i.e., core plus inner layer) which could be easily molded over with the soft outer layer materials of choice. The goal herein was to use as thin an outer layer as necessary to achieve the desired playability characteristics while minimizing the cost of the more expensive outer materials.

However, with a larger diameter final golf ball and/or if the cover is compression molded, a thinner cover becomes feasible.

With the above in mind, an outer cover layer composition was blended together in accordance with conventional blending techniques. The outer layer composition used for this portion of the example is a relatively soft cover composition such as those listed in U.S. Patent No. 5,120,791. An example of such a soft cover composition is a 45% soft/55% hard low acid ionomer blend designated by the inventor as "TE-90". The composition of TE-90 is set forth below in Table 12 as follows:

Outer Cover Layer Composition TE-90

Iotek® 8000	22.7 weight %
Iotek® 7030	22.7 weight %
Iotek® 7520	45.0 weight %
White MB[1]	9.6 weight %

[1]White MB consists of about 23.77 weight percent TiO_2, 0.22 weight percent Uvitex® OB, 0.03 weight percent Santonox® R, 0.05 weight percent Ultramarine Blue™ and 75.85 weight percent Iotek® 7030.

The above outer layer composition was molded around each of the 1.620 diameter intermediate balls comprising a core plus one of compositions A-D, respectively. In addition, for comparison purposes, Surlyn® 1855 (new Surlyn® 9020), the cover composition of the '193 patent, was molded about the inner layer of composition D (the intermediate ball representative of the '193 patent). The outer layer TE-90 was molded to a thickness of approximately 0.030 inches to produce a golf ball of approximately 1.680 inches in diameter. The resulting balls (a dozen balls for each example) were tested and the various properties thereof are set forth in Table 6A as follows:

TABLE 6A

Finished Balls

Ingredients:	1	2	3	4	5
Inner Cover Composition	A	B	C	D	D
Outer Cover Composition	TE-90	TE-90	TE-90	TE-90	Surlyn® 9020
Properties of Molded Finished Balls:					
Compression	63	63	69	70	61
C.O.R.	.784	.778	.780	.770	.757
Shore C Hardness	88	88	88	88	89
Spin (R.P.M.)	8,825	8,854	8,814	8,990	8,846
Cut Resistance	3-4	3-4	3-4	3-4	1-2

As it will be noted in finished balls 1-4, by creating a multi-layer cover utilizing the high acid ionomer resins in the inner cover layer and the hard/soft low acid ionomer resin in the outer cover layer, generally higher compression and increased spin rates are noted over the single layer covers of Table 11. In addition, both the C.O.R. and the Shore C hardness are reduced over the respective single layer covers of Table 11. This was once again particularly true with respect to the multi-layered balls containing the high acid ionomer resin in the inner layer (i.e. finished balls 1-4). In addition, with the exception of prior art ball 5 (i.e. the '193 patent), resistance to cutting remains good but is slightly decreased. As noted above, the prior art ball of the '193 patent suffers substantially in durability (as well as in resiliency) in comparison to the balls of the present invention.

Furthermore, it is also noted that the use of the high acid ionomer resins as the inner cover material produces a substantial increase in the finished balls' overall distance properties. In this regard, the high acid ionomer resin inner covers of balls 1-3 produce an increase of approximately 10 points in C.O.R. over the low acid ionomer resin inner covers of balls 4 and about a 25 point increase over the prior art balls 5. Since an increase in 3 to 6 points in C.O.R. results in an

average increase of about 1 yard in distance, such an improvement is deemed to be significant.

Several other outer layer formulations were prepared and tested by molding them around the core and inner cover layer combination to form balls each having a diameter of about 1.68 inches. First, B.F.Goodrich Estane® X-4517 polyester polyurethane was molded about the core molded with inner layer cover formulation A. DuPont Surlyn® 9020 was molded about the core which was already molded with inner layer D. Similar properties tests were conducted on these golf balls and the results are set forth in Table 6B below:

TABLE 6B

Finished Balls

Ingredients:	6	7
Inner Cover Layer Composition	A	D
Outer Cover Layer Composition	Estane® 4517	Surlyn® 9020
Properties of Molded Finished Balls:		
Compression	67	61
C.O.R.	.774	.757
Shore C Hardness	74	89
Spin (R.P.M.)	10,061	8,846
Cut Resistance	3-4	1-2

The ball comprising inner layer formulation D and Surlyn® 9020 identifies the ball in the Nesbitt 4,431,193 patent. As is noted, the example provides for relatively high softness and spin rate though it suffers from poor cut resistance and low C.O.R. This ball is unacceptable by today's standards.

As for the Estane® X-4517 polyester polyurethane, a significant increase in spin rate over the TE-90 cover is noted along with an increased compression. However, the C.O.R. and Shore C values are reduced, while the cut resistance remains the same. Furthermore, both the Estane® X-4517 polyester polyurethane and the Surlyn® 9020 were relatively difficult to mold in such thin sections.

Example 2

In order to analyze the change in characteristics produced by multi-layer golf balls (standard size) having inner cover layers comprised of ionomer resin blends of different acid levels, a series of experiments were run. Specifically, 14 tests were performed, varying the type of core, inner cover layer and outer cover layer. The results are shown below:

TABLE 7

	Sample #	Core	INNER LAYER	THICKNESS	COMP/ COR	OUTER COVER	THICKNESS	COMP (Rhiele)	COR	SHORE D	SPIN
	8	1042 YELLOW	NONE	----	SEE BELOW	TOP GRADE	0.055	61	.800	68	7331
5	9	1042 YELLOW	NONE	--------	SEE BELOW	959/960	0.055"	56	.808	73	6516
	10	SPECIAL 1.47"	959/960	0/050"	65/.805	959/960	O.055"	48	.830	73	6258
	11	1042 YELLOW	NONE	--------	SEE BELOW	SD 90	0.055"	62	.792	63	8421
	12	SPECIAL 1.47"	TOP GRADE	0.050"	66/.799	SD 90	0.055"	55	.811	63	8265
	13	SPECIAL 1.47"	959/960	0.050"	65/.805	SD 90	0.055"	53	.813	63	8254
10	14	SPECIAL 1.47"	TOP GRADE	0.050"	66/.799	TOP GRADE	0.055"	51	.819	68	7390
	15	1042 YELLOW	NONE	--------	SEE BELOW	Z-BALATA	0.055"	67	.782	55	9479
	16	SPECIAL 1.47"	959/960	0.050"	65/.805	Z-BALATA	0.055"	61	.800	55	9026
	17	SPECIAL 1.47"	TOP GRADE	0.050"	66/.799	Z-BALATA	0.055"	60	.798	55	9262

1042 YELLOW>COMP=72, COR=.780
15 SPECIAL 1.47" CORE>COMP=67, COR=.782

In this regard, Top Grade or TG is a low acid inner cover ionomer resin blend comprising of 70.6% Iotek® 8000, 19.9% Iotek® 7010 and 9.6% white masterbatch. "959/960" is a 50/50 wt/wt blend of Iotek® 959/960. In this regard, Escor® or Iotek® 959 is a sodium ion neutralized ethylene-acrylic neutralized ethylene-acrylic acid copolymer. According to Exxon, Iotek® 959 and 960 contain from about 19.0 to about 21.0% by weight acrylic acid with approximately 30 to about 70 percent of the acid groups neutralized with sodium and zinc ions, respectively. The physical properties of these high acid acrylic acid based ionomers are as follows:

PROPERTY	ESCOR® (IOTEK®) 959	ESCOR® (IOTEK®) 960
Melt Index, g/10 min	2.0	1.8
Cation	Sodium	Zinc
Melting Point, °F	172	174
Vicat Softening Point, °F	130	131
Tensile @ Break, psi	4600	3500
Elongation @ Break, %	325	430
Hardness, Shore D	66	57
Flexural Modulus, psi	66,000	27,000

Furthermore, the low acid ionomer formulation for SD 90 and Z-Balata are set forth below:

SD Cover	ZB Cover
17.2% Surlyn® 8320	19% Iotek® 8000
7.5% Surlyn® 8120	19% Iotek® 7030
49% Surlyn® 9910	52.5% Iotek® 7520
16.4% Surlyn® 8940	9.5% white MB
9.7% white MB	

The data clearly indicates that higher C.O.R. and hence increased travel distance can be obtained by using multi-layered covered balls versus balls covered with single layers. However, some sacrifices in compression and spin are also noted. Further, as shown in comparing Example Nos. 12 vs. 13, Example

Nos. 17 vs. 16, etc., use of lower acid level inner cover layers and relatively soft outer cover layers (i.e., 50 wt. % or more soft ionomer) produces softer compression and higher spin rates than the golf balls comprised of high acid inner cover layers. Consequently, use of blends of low acid ionomer resins to produce the inner layer of a multi-layer covered golf ball produces not only enhanced travel distance but also enhanced compression and spin properties.

Example 3

Multi-layer oversized golf balls were produced utilizing different ionomer resin blends as the inner cover layer (i.e., core plus inner cover layer is defined as "mantel"). The "ball data" of the oversized multi-layer golf balls in comparison with production samples of Top-Flite® XL and Top-Flite® Z-Balata is set forth below.

TABLE 8

	18	19	20	21 Top-Flite® XL	22 Top-Flite® Z-Balata 90
Core Data					
Size	1.43	1.43	1.43	1.545	1.545
COR	.787	.787	.787	---	---
Mantle Data					
Material	TG	TG	TG	---	---
Size	1.61	1.61	1.61	---	---
Thickness	.090	.090	.090	---	---
Shore D	68	68	68	---	---
Compression	57	57	57	---	---
COR	.815	.815	.815	---	---
Ball Data					
Cover	TG	ZB	SD	TG	ZB
Size	1.725	1.723	1.726	1.681	1.683
Weight	45.2	45.1	45.2	45.3	45.5
Shore D	68	56	63	68	56
Compression	45	55	49	53	77
COR	.820	.800	.810	.809	.797
Spin	7230	9268	8397	7133	9287

The results indicate that use of multi-layer covers enhances C.O.R. and travel distance. Further, the data shows that use of a blend of low acid ionomer resins (i.e., Top Grade) to form the inner cover layer in combination with a soft outer cover (ZB or SD) produces enhanced spin and compression characteristics. The overall combination results in a relatively optimal golf ball with respect to characteristics of travel distances, spin and durability.

Example 4

Castable Polyurethane Covered Multi-layer Balls

A limited number of samples were made using BASF Baytec® RE232 polyurethane as a cover material over four different types of mantle cores. Controls included Z-Balata 100s along with the same mantle cores used for the polyurethane samples covered with Z-Balata cover stock. Mantle cores were made up of 82 and 58 compression cores covered with Iotek® 8030/7030.

Castable PU Molding Process

Materials used:

Baytec® RE832, mix ratio 9 parts A/12 parts B
1 - 1.57" i.d. smooth cavity
2 - 1.68" i.d. dimpled cavities
1 - 2" hose clamp
1 - bench vise or large C-clamp

Sub A25

~~(The smooth and dimpled cavities are the same O.D.)~~

The mantle core is 1.57" and fits snugly in the 1.57" cavity. The hose clamp is attached to the 1.57" cavity and a mantle core is placed inside. Urethane is mixed and poured into one of the dimpled cavities and the two halves are placed together and clamped, forcing out excess material and forming half the cover. The hose clamp is used to keep the two mold halves aligned during curing. When the cover material is set up enough (about 5 minutes), the two halves are separated and the 1.57" mold is replaced with the other 1.68" mold and the process is repeated. Both halves of the cover are now cast and the entire assembly is placed ~~in an 125°F oven for 1 hour after which it can be opened and the ball removed~~.

All samples were finished using normal production equipment and procedures. The properties of the finished balls are set forth below:

TABLE 9

		23	24	25	26	27	28	29	30
	Core Data								
	Size	1.47"	1.47"	1.47"	1.47"	1.47	1.47"	1.47"	1.47"
	Weight	32.2	32	32.2	32	37.7	32.2	32	32.2
5	Comp	82	58	82	58	85	82	58	82
	COR	768	772	768	772	794	768	772	768
	Mantle Data	Iotek®	Iotek®	Iotek®	Iotek®		Iotek®	Iotek®	Iotek®
	Material	8030/7030	8030/7030	8030/7030	8030/7030	None	8030/7030	8030/7030	8030/7030
	Weight	37.8	38.1	37.9	38.1		37.8	38.1	37.9
10	Size	1.57"	1.57"	1.57"	1.57"		1.57"	1.57"	1.57"
	Comp	70	48	69	48		70	48	69
	COR	781	785	786	788		781	785	786
	Ball Data								
	Cover Material	Baytec® RE832	Baytec® RE832	Baytec® RE832	Baytec® RE832	Z-Balata	Z-Balata	Z-Balata	Z-Balata
15	Weight	45.4	45.5	45.5	45.2	45.3	44.8	45	
	Comp	75	64	73	60	80	66	50	65
	COR	771	763	770	761	792	775	774	778
	Shore C	65	65	65	65	84	84	84	84
	Spin (rpm)	9560	8789	9285	8760	8796	8702	9072	8643
20	Cut (1-good, 4-poor)	2	2	2	1.5	2	2	2	2
	Scuff (1-good, 4-poor)	1.5	1.5	1.5	1.5	2	3	3	3

34

Table 9 contains the construction details and test results. Multilayer balls with the thermoset urethane covers (Examples 23-25) were softer in compression and similar in COR to the multi-layer balls with the Z-Balata cover (Examples 27-29). Shore C was much lower for the urethane balls and they were more resistant to scuff than any of the Z-Balata covered balls. Guillotine cut resistance was about the same. Spin rate comparison shows that the urethane samples are better than the Z-Balata covered balls.

Test results indicate that a very good multi-layer ball can be made using castable polyurethane cover material. Further, advantages include the molding of very thin covers, molding over very soft compression core/mantle, and low cost tooling.

~~The invention has been described with reference to the preferred~~ embodiments. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the ~~appended~~ claims or the equivalents ~~thereof~~.

Sub A25

I claim:

1. A golf ball comprising:

a core;

an inner cover layer disposed on said core, said inner cover layer having a Shore D hardness of at least 60, said inner cover layer comprising a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and

an outer cover layer disposed on said inner cover layer, said outer cover layer having a Shore D hardness of from about 55 to about 59, a thickness of from about 0.01 to about 0.07 inches, and comprising a polyurethane material.

2. The golf ball of claim 1 wherein said outer cover exhibits a Shore D hardness of from about 56 to about 58.

3. The golf ball of claim 1 wherein said outer cover exhibits a Shore D hardness of about 57.

~~4.~~ 2 The golf ball of claim 1 wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.

~~5.~~ 3 The golf ball of claim 1 wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.

Sub A29

6. A golf ball comprising:

a core;

an inner cover layer disposed about said core, said inner cover layer having a Shore D hardness of at least 60, said inner cover layer comprising a blend of two or more low acid ionomer resins, each containing no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid; and

an outer cover layer disposed on said inner cover layer, said outer cover layer having a Shore D hardness of from about 60 to about 68, a thickness of from about 0.01 to about 0.07 inches, and comprising a polyurethane material.

7. The golf ball of claim 6 wherein said outer cover exhibits a Shore D hardness of from about 62 to about 66.

8. The golf ball of claim 6 wherein said outer cover exhibits a Shore D hardness of from about 63 to about 64.

9. The golf ball of claim 6 wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.

10. The golf ball of claim 6 wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.

11. A golf ball comprising:

a core;

an inner cover layer disposed on said core, said inner cover layer having a Shore D hardness of about 60 or more, said inner cover layer comprising an ionomeric resin including no more than 16% by weight of an alpha, beta-unsaturated carboxylic acid and having a modulus of from about 15,000 to about 70,000 psi; and

an outer cover layer disposed about said inner cover layer, said outer cover layer having a Shore D hardness of from about 55 to about 68, a thickness of from about 0.01 to about 0.07 inches, and comprising a polyurethane material.

12. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of from about 56 to about 58.

13. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of about 57.

14. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of from about 62 to about 66.

15. The golf ball of claim 11 wherein said outer cover exhibits a Shore D hardness of from about 63 to about 64.

16. The golf ball of claim 8 wherein said outer cover layer has a thickness of from about 0.01 to about 0.05 inches.

17. The golf ball of claim 8 wherein said outer cover layer has a thickness of from about 0.03 to about 0.06 inches.

IMPROVED MULT-LAYER GOLF BALL

~~GOLF BALL HAVING MULTI-LAYER COVER~~
~~WITH UNIQUE OUTER COVER~~ CHARACTERISTICS

ABSTRACT

The present invention is directed to an improved multi-layer golf ball comprising a core, an inner cover layer and an outer cover layer. The inner cover layer is comprised of a low acid ionomer blend which may or may not include a filler such as zinc-stearate. The outer cover layer is comprised of a soft, non-ionomeric thermoplastic or thermosetting elastomer such as polyurethane, polyester or polyesteramide. The resulting multi-layered golf ball of the present invention provides for enhanced distance without sacrificing playability or durability when compared to known multi-layer golf balls.

C:\DATA\MEBV\APPLNS\SLD20353.111

Docket No.: P-3724-2/SLD 2 035-3-3

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am an original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

IMPROVED MULTI-LAYER GOLF BALL

the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37 Code of Federal Regulations § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

None

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Donald R. Bahr, Reg. No. 21,011
Christopher B. Fagan, Reg. No. 22,987
Richard M. Klein, Reg. No. 33,000

Address all telephone calls to: Richard M. Klein
at telephone number: (216) 861-5582
Address all correspondence to:

Donald R. Bahr, Esq.
SPALDING & EVENFLO COMPANIES, INC.
5730 North Hoover Boulevard
Tampa, Florida 33634

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Michael J. Sullivan

Inventor's signature Michael J Sullivan

Date: October 31, 1995

Residence: 58 Marlborough Street
Chicopee, Massachusetts 01021

Citizenship: U.S.A.

Post Office Address: 58 Marlborough Street
Chicopee, Massachusetts 01021

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 5311

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
09/873,642	06/04/2001 RULE	473	3711	P-3724-F1-C1-C3

APPLICANTS
Michael J. Sullivan, Barrington, RI;

**** CONTINUING DATA ***************************
THIS APPLICATION IS A CON OF 09/776,278 02/02/2001 Gorden
WHICH IS A CON OF 09/470,196 12/21/1999 PAT 6,210,293 Graham
WHICH IS A CON OF 08/870,585 06/06/1997 ABN
WHICH IS A CON OF 08/556,237 11/09/1995 ABN
WHICH IS A CIP OF 08/070,510 06/01/1993 ABN
RG 9-26-02

**** FOREIGN APPLICATIONS *********************
RG 9-26-02

IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 06/22/2001

Foreign Priority claimed	35 USC 119 (a-d) conditions met	Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☒ no	☐ yes ☐ no ☐ Met after Allowance	Examiner's Signature / Initials	RI	1	17	3

ADDRESS
24492

TITLE
Golf ball having multi-layer cover with unique outer cover characteristics

FILING FEE RECEIVED	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit
710		

CW 0308051

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

06/08/2001 DTESSEM1 00000054 09873642
01 FC:101 710.00 OP

PTO-1556
(5/87)

*U.S. GPO: 1999-459-082/19144

Application or Docket Number

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 2000

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	17	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	17 minus 20=	* 0
INDEPENDENT CLAIMS	3 minus 3 =	* 0
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL		OR	TOTAL	710

CLAIMS AS AMENDED - PART II

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 12	Minus	** 20	=
Independent	* 3	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 8/00)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
*U.S. GPO: 2000-460-708/3010

CW 0308053

CLAIMS ONLY

SERIAL NO. 09873642 | FILING DATE

APPLICANT(S)

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1					
2		1				
3		1				
4		1				
5		1				
6	1					
7		1				
8		1				
9		1				
10		1				
11	1					
12		1				
13		1				
14		1				
15		1				
16		1				
17		1				
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
TOTAL IND.	3					
TOTAL DEP.	14					
TOTAL CLAIMS	17					

	*		*		*	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						
TOTAL IND.						
TOTAL DEP.						
TOTAL CLAIMS						

* MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

FORM PTO-2022 (1-98)

U.S.DEPARTMENT OF COMMERCE
Patent and Trademark Office

*U.S. GPO: 1998-443-593/89152

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF	:	Michael J. Sullivan
FOR	:	**GOLF BALL HAVING MULTI-LAYER COVER WITH UNIQUE OUTER COVER CHARACTERISTICS**
SERIAL NO.	:	Unknown
FILED	:	Herewith
ART UNIT	:	3711
CUSTOMER NO.	:	24492
ATTORNEY DOCKET NO.	:	P-3724-2-F1-C1-C3 SLD 2 035-3-3-1-1-1(III)

Cleveland, Ohio 44114
June 1, 2001

Assistant Commissioner for Patents
Washington, D.C. 20231

INFORMATION DISCLOSURE STATEMENT

Dear Sir:

Applicants submit herewith patents, publications or other information of which they are aware, which they believe may be material to the examination of the above-identified application and in respect of which there may be a duty to disclose in accordance with 37 C.F.R. 1.56.

This Information Disclosure Statement is not intended to constitute an admission that any patent, publication or other information referred to herein or submitted herewith is "prior art" for this invention unless specifically designated as such.

In accordance with 37 C.F.R. 1.97(g) and (h), the filing of this Information Disclosure Statement shall not be construed to mean that a search has been made or that no other material information as defined in 37 C.F.R. 1.56(b) exists.

The following list of art includes all patents, publications, or other information previously cited by or submitted to the Office in one or more prior applications from which the present application claims priority. These one or more prior applications are identified in the papers accompanying the filing of this application. In

accordance with § 609 MPEP, it is not necessary to submit copies of the art listed on the enclosed Form PTO-1449.

It is respectfully requested that the attached documents be considered and officially cited in examination of this application.

Respectfully submitted,

FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP

Richard M. Klein
Reg. No. 33,000
Mark E. Bandy
Reg. No. 35,788
1100 Superior Avenue
Suite 700
Cleveland, Ohio 44114-2518
(216) 861-5582

C:\DATA\MEB\S2035331.IDS

Attorney Docket No.: P-3724-F1-C1-C3
(SLD 2035-3-3-1-1-1(III))

APPLICATION DATA SHEET

Inventor Information

Inventor One Given Name::	Michael J.
Family Name::	Sullivan
Postal Address Line One::	3 River Oak Road
City::	Barrington
State or Province::	RI
Postal or Zip Code::	02806
Citizenship Country::	US

Correspondence Information

Name Line One::	Michelle Bugbee
Name Line Two::	Spalding Sports Worldwide, Inc.
Address Line One::	425 Meadow Street
Address Line Two::	PO Box 901
City::	Chicopee
State or Province::	MA
Postal or Zip Code::	01021-0901
Telephone::	(413)322-2937
Fax::	(413)322-2575
E-Mail::	MBugbee@Spalding.com
Customer No.::	24492

Additional Correspondence Information

Name Line One::	Richard M. Klein
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	RKlein@faysharpe.com

Application Information

Title Line One::	Golf Ball Having Multi-Layer Cover With
Title Line Two::	Unique Outer Cover Characteristics
Total Drawing Sheets::	1
Formal Drawings?::	Yes
Application Type::	Utility

Representative Information

The following have a power of Attorney or autorization of agent in this application:

Name Line One::	Michelle Bugbee
Name Line Two::	Spalding Sports Worldwide, Inc.
Address Line One::	425 Meadow Street
Address Line Two::	PO Box 901
City::	Chicopee
State or Province::	MA
Postal or Zip Code::	01021-0901
Telephone::	(413)322-2937
Fax::	(413)322-2575
E-Mail::	MBugbee@Spalding.com
Registration No.::	42,370

Name Line One::	Richard M. Klein
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	RKlein@faysharpe.com
Registration No.:	33,000

Name Line One::	Mark E. Bandy
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	MBandy@faysharpe.com
Registration No.:	35,788

Name Line One::	Brian G. Bembenick
Name Line Two::	Fay Sharpe et al.
Address Line One::	1100 Superior Avenue
Address Line Two::	Seventh Floor
City::	Cleveland
State or Province::	OH
Postal or Zip Code::	44114
Telephone::	(216)861-5582
Fax::	(216)241-1666
E-Mail::	BBembenick@faysharpe.com
Registration No.:	41,463

Continuity Information

This application is a::	Continuation of
> Application One::	09/776,278
Filing Date::	February 2, 2001
which is a::	Continuation of
> Application Two::	09/470,196
Filing Date::	December 21, 1999 - 6,210,293
which is a::	Continuation of
>> Application Three::	08/870,585
Filing Date::	June 6, 1997 - ABANDONED
which is a::	Continuation of
>>> Application Four:	08/556,237
Filing Date::	November 9, 1995
Status::	Abandoned
which is a::	Continuation-in-Part of
>>> Application Five:	08/070,510
Filing Date::	June 1, 1993
Status::	Abandoned

Prior Foreign Applications

Foreign Application One::
Filing Date::
Country::
Priority Claimed:: (Y or N)

Assignee Information

The Assignee of this application is to:

SPALDING SPORTS WORLDWIDE, INC.
425 Meadow Street, PO Box 901
Chicopee, MA 01021-0901
(413) 322-2937

Richard M. Klein
Reg. No.33,000
Mark E. Bandy
Reg. No. 35,788
1100 Superior Avenue
7th Floor
Cleveland, OH 44114-2518
Telephone No. (216)861-5582
Customer No. 24492

C:\DATA\DATASHEE\SLD\20353311.13

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/873,642	06/04/01	SULLIVAN	M P-3724-F1-C1

EXAMINER	
GORDON, R	
ART UNIT	**PAPER NUMBER**
3711	3

024492 QM32/0914
MICHELLE BUGBEE, ASSOCIATE PATENT COUNSE
SPALDING SPORTS WORLDWIDE INC
425 MEADOW STREET
PO BOX 901
CHICOPEE MA 01021-0901

DATE MAILED: 08/14/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No. 09/873,642	Applicant(s) SULLIVAN, MICHAEL J.	
	Examiner Raeann Gorden	Art Unit 3711	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 June 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-17 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8 of U.S. Patent No. 6,210,293. Although the conflicting claims are not identical, they are not patentably distinct from each other because the '293 patent and the present application claim golf balls comprising a core, an inner cover layer and an outer cover layer. The inner cover layer is made from ionomer and acid and the outer cover layer is made from a polyurethane.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raeann Gorden whose telephone number is (703) 308-

8354. The examiner can normally be reached Monday-Thursday and alternating Fridays from 8:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeanette Chapman, can be reached on 703-308-1310. The fax number for the organization where this application or proceeding is assigned is 703-308-7768.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1148.

Rg
August 9, 2001

Mark S. Graham
Primary Examiner

Notice of References Cited	Application/Control No. 09/873,642	Applicant(s)/Patent Under Reexamination SULLIVAN, MICHAEL J.	
	Examiner Raeann Gorden	Art Unit 3711	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification	
	A	US-6210293	04-2001	Sullivan	473	374
	B	US-5314187	05-1994	Proudfit	473	373
	C	US-5068151	11-1991	Nakamura	473	374
	D	US-4431193	02-1984	Nesbitt	473	373
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification	
	N						
	O						
	P						
	Q						
	R						
	S						
	T						

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.